FOODS

Nutrition and Digestion

KNOW THYSELF SERIES

SECOND EDITION

The author, in giving remedial exercises and diet prescribed to suit the individual need, has for ten years realized the necessity of a book which shall give to the homemaker a clear idea of the uses of foods, that she may be able to compile her own diets for various blood conditions. Since the blood is made from food elements, its conditions can be largely controlled by a knowledge and regulation of these elements.

Acknowledgment is here made of the valuable assistance of Winfield S. Hall, Ph. D., M. D., Professor of Physiology of Northwestern Medical School, Lecturer and Author of Nutrition and Dietetics; of Alida Frances Pattee, late instructor of Dietetics Bellevue Training School for Nurses, Bellevue Hospital, New York City, author of "Practical Dietetics with reference to Diet in Disease," and of D. Appleton & Co., for their kindness in allowing the use of Dr. Hall's tables of food values, in the preparation of this book.

The tables of Food Values and the classifications of foods are kindly furnished by Dr. Hall and used by the courtesy of his publishers, while a few of the receipts are generously furnished by Miss Pattee.

Recognition is also made of the good work of Miss Helen Hammel, former dietitian in Wesley Hospital, Chicago, in the preparation of some of the receipts in the Appendix.

FOODS
Nutrition and Digestion

BY

SUSANNA COCROFT

AUTHOR OF

GROWTH IN SILENCE
SELF SUFFICIENCY
THE VITAL ORGANS
HABITS: THE NERVES
POISE AND SYMMETRY OF FIGURE
CHARACTER AS EXPRESSED IN THE BODY
IDEALS AND PRIVILEGES OF WOMAN
ETC., ETC.

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The problem of proper nutrition for the body is as vital as any study affecting the morals, health, and consequent power of a nation, since upon the quality and quantity of food assimilated, depend the sustenance, health, and strength of its citizens.

The study of life is the most vital interest in nature. The human race spends more time in providing nourishment for the body than in any other line of activity. Next to nourishment comes self-preservation. It is intuitive, the infant's first instinct is the preservation of life; almost at once he seeks for nourishment. His body

is ever an awakening wonder to him. He begins his education by a study of his hands, his legs, and his flesh.

"The physical satisfactions of life, the joys of mental development, the inspiration of soul, the sense of growth, of expansion, and of largest happiness, the self-satisfaction of greatest usefulness, and the glorifying results of this usefulness, come in largest measure only to the person whose nutriment is proper in quantity, quality, and form and is taken properly, as to time, mastication, swallowing, and digestion, with sufficient exercise to give the body activity to convert it into use. This enjoyment of vibrant life is far beyond the joys of the intemperate or the æsthetic." That ones energies of thought may not be constantly engaged in deciding what is best, it is important that proper *habits* be formed. Habit calls for no conscious energy.

Scientific research along the lines of electricity, psychology, metaphysics, medicine, and art has been tenaciously pursued for centuries; yet scientific study of the natural means of keeping the body in health, that the individual may be in physical, mental, and moral condition to enjoy and to profit by researches made in other

lines, has been neglected. The result is, that man does not enjoy life to the full, nor make his physical nor mental efforts yield the best returns.

It is necessary to know the comparative values of foods as nutrient agents, in order to maintain our bodies in health and strength, and with economy of digestive effort, as well as efficiency. The entire body,—bone, muscle, blood, brain, nerve, heat and energy,—is formed from the food and drink taken into the stomach and from the oxygen breathed into the lungs; the mental and physical activity also depends upon the food. There is no study, therefore, more important than that of bodily nutrition and the preparation of food and drink in right proportions to yield the best returns under varying conditions,—age, employment, health, and sickness.

Nutrition is a broad subject. It means not only that the foods be supplied which contain elements required to rebuild body substance and to create heat and energy, but it embraces, also, the ability of the body to appropriate the foods to its needs. The study of nutrition in its full sense, therefore, must embrace foods, anatomy and physiology (particularly of the digestive system), and chemistry, in order to know

the changes foods must undergo in being converted into tissue, heat and energy* This study, reduced to a science, is known as Dietetics. There is no more important study for public schools, or for woman's clubs.

Nutrition must be solved largely through chemistry. The health and efficiency of the individual and of the Nation depend upon careful study of the chemical components of foods and the control of the foods placed upon the market. The "pound of cure" in the study of materia medica has been given much thought,—the "ounce of prevention," little.

The former custom of employing a physician as a retainer had its distinct advantage, his duty being to instruct in right living so as to *avoid* disease rather than to *cure* it. To-day scientific instruction in food and hygiene is within the reach of all, and every mother and teacher is a retainer, or guard of the health of those in her charge.

Happily, the United States Government, realizing that its power as a nation depends

* It is impossible in this book to go into the anatomy and physiology of digestion exhaustively.—The reader is respectfully referred to Miss Cocroft's book upon "The Vital Organs: their Use and Abuse." This traces the food through the digestive canal, indicating the juices which act upon it, putting it into a necessary state to be absorbed by the body and appropriated to its various uses.

upon the strength and health of its citizens, has established experimental and analytical food departments. As a result of the findings of the governmental chemists, there was enacted in 1906, the Food and Drug Act, which aims to raise the standard of food purity, by prescribing the conditions under which foods may be manufactured and sold. The law compels the maker of artificially colored or preserved food products to correctly label his goods. The national law was the instigation of state laws, which have further helped to insure a supply of pure food products.

Every particle of body substance is constantly changing. The new material for cells and tissues, the substance to supply the energy needed in the metabolic work of tearing down and rebuilding, the energy used in the digestive process of converting the food into condition to be assimilated, and the energy used in muscular, brain, and nerve movement, must all be supplied by food. Every brain effort in the process of thinking, every motion, and every muscular movement requires energy which the food must supply.

Brain workers, or habitual worriers, use up force and become thin quite as quickly

as those whose work is muscular. The term "brain workers" is commonly applied to professional men or women,—to authors, editors, teachers, or to those engaged in business, but the woman who manages her household judiciously, or the woman who spends her life fretting over existing conditions, or worrying over things which never happen, uses quite as much brain force. The difference is that the former accomplish results outside of themselves, while the latter simply stirs up disagreeable conditions within, resulting in physical ills.

The whole problem of perfect health and efficient activity is in keeping the supply of assimilated food equal to the demand, in keeping a forceful circulation that the nourishment may freely reach all tissues and the waste be eliminated, and in full breathing habits that sufficient oxygen be supplied to put the waste in condition for elimination.

The body is certainly a marvelous machine! It is self-building, self-repairing, and, to a degree, self-regulating.

It appropriates to its use food-stuffs for growth and for repair.

It eliminates its waste.

It supplies the energy for rebuilding, and eliminating this waste.

It directs its own emotions.

It supplies the energy for these emotions.

It discriminates in the selection of food and casts out refuse and food not needed.

It forms brain cells and creates mental force with which to control the organism.

It keeps in repair the nerves, which are the telegraph wires connecting the brain with all parts of the body.

It converts the potential energy in the food into heat with which to keep itself warm.

Withal it is not left free to do its work automatically. It has within it a higher intelligence, a spiritual force, which may definitely hamper its workings by getting a wrong control of the telegraph wires, thus interfering with the digestion, the heart action, the lungs and all metabolic changes. The right exercise of this higher intelligence, in turn, depends upon the condition of the body, because when the mechanism of the body is out of repair it hampers mental and spiritual control.

Surely man is marvelously made!

The intelligent care of the body,—the temple through which the soul communicates with material conditions,—is a Christian duty. "The priest with liver trouble and the parishioner with indigestion, do not evidence that skilled Christian living so essential to the higher life."

Certain it is that improper foods affect the disposition, retard the spiritual growth and change the drift of one's life and of the lives about one.

Man has become so engrossed and hedged about with the complex demands of social, civic, and domestic life, all of which call for undue energy and annoyance and lead him into careless or extravagant habits of eating and living, that he forgets to apply the intelligence which he puts into his business to the care of the machine which does the work. Yet the simple laws of nature in the care of the body, are plainer and easier to follow than the complex habits which he forms. The "simple life" embraces the habits of eating as well as the habits of doing and of thinking.

PURPOSES OF FOOD

The purposes of food are:

To supply the material of which the body is made

To rebuild tissue, which is constantly being torn down and eliminated.

To produce heat, and to supply muscular and mental energy.

Let us discuss these purposes in above order.

Food Supply

By food supply is meant not only that the proper foods in kind and quantity be eaten, but that the body be in condition to digest, absorb, and assimilate the foods, and to eliminate the waste, otherwise the foods fail to supply the body needs. It is the nourishment which the body assimilates and appropriates to its needs which counts in food economy.

Of the fifteen to twenty substances contained in foods and comprising the body, the most abundant are oxygen, hydrogen, carbon, nitrogen, chlorin, sodium, potassium, magnesium, iron, calcium, phosphorus, and sulphur. All living matter, plant or animal, contains oxygen, hydrogen, carbon and nitrogen; the difference in the form and use of the matter is in the proportions of these elements.

Carbon combined with oxygen forms carbon dioxid. Hydrogen, nitrogen, and carbon dioxid form the air. Oxygen and hydrogen form water. Calcium, iron, magnesium, sodium, and potassium form the majority of rocks.

The substances contained in living organisms are the same as those in inorganic matter, only in different complexities as appropriated to each need. This difference in complexity of combinations of the same elements in a body is the physical difference between a living and a nonliving plant or animal.

By far the most important change which the food must undergo to convert it from raw material into a state for conversion into body needs is the chemical change. While the body needs carbon, it cannot use coal; it needs nitrogen, yet it cannot

appropriate it to rebuilding bone and muscle until, by chemical action with other elements within, it has been converted into complex substances called proteins; again, the chemical action of oxygen breaks down the proteins.

The muscles, ligaments, and labor-performing structures contain the largest amount of proteins; the fats and the carbohydrates contain the largest amount of carbonaceous compounds; the brain, the nerves, and the bones contain the largest portion of phosphorous compounds; yet, while the brain contains phosphorus, and the muscles nitrogen, the brain cannot be built up by eating elementary phosphorus, nor the muscles by pure nitrogen, but compounds rich in phosphorus or nitrogen may be utilized. It has been demonstrated by scientific investigation that no unorganized element is assimilated by the system and converted into its various structures.

The gluten of wheat is built up by the chemical union of nitrogen in the air and nitrogen in the soil with other substances. Plants are able to use the simple compounds of the earth, air, and soil, and, within their own cells, build them up into such complex substances as starch, sugar,

protein, fat, and salt, which are appropriated by the animal kingdom for further growth and change.

In its conversion into tissue, heat, energy, and waste, the importance of the chemical exceeds the mechanical action, such as digestion, absorption, assimilation, and elimination; yet the chemical changes are aided by the mechanical.

Each individual should know, approximately, the chemical constituents and the proportion of these constituents in normal blood, because from the elements in the blood, the tissues are constructed. If certain elements be lacking, the foods containing these elements in largest proportions should be supplied until the blood no longer shows the deficiency. This is Nature's method of correction.

Each meal, or each day's food, may not contain just the amounts of protein or of fuel ingredients necessary for that day's work and re-supply, but the body is continually storing material, and this reserve is constantly being drawn upon to provide any element which may be lacking in that day's supply. Thus, an excess or a deficiency one day may be adjusted the next. Healthful nourishment requires that the balance, as a whole, be kept, and that a

deficiency or over-supply be not continued for too long.

Many domestic animals take their food elements from air and water, as well as from the compounds which the plants have formed; while others make use of meat, a compound formed by another animal. The digestive forces of the animal has converted these elements into flesh, a compound easily assimilated by another.

The greater part of the muscles, nerves, and glands of the animal kingdom is *protein.* The skeleton is composed largely of deposited salts, while the elements which supply heat and keep up muscular activity are *starches, fats, and sugars.*

The *proteins* are appropriated by man from plants, but they are furnished to him in more easily digested form in lean meat and eggs, the lower animals having done much of the work of digestion, converting the proteins from plant life into more condensed form. On the other hand, by access to this concentrated form of easily digested protein, man is in danger of taking in too much of this condensed food, if he eats a large quantity of meat and eggs.

It must be apparent to every thoughtful person, since the nerves, muscles, and glands are composed largely of protein

and the skeleton largely of salt, that, in order to furnish the body with the elements necessary for growth and repair, these elements must be provided, as also the substances producing the energy for the working body. *Each individual should make a self-study to know how much re-supply is required to renew the daily waste.*

About one-third of the food eaten goes to maintain the life of the body in doing its incessant work of repairing and rebuilding, the remaining two-thirds is the reserve for usefulness outside of itself.

One of the most remarkable, and the least understood of any of the assimilative and absorptive functions, is that any one part of the body has the power to appropriate from the foods the elements necessary for its own rebuilding, while these same elements pass through other organs untouched. The body has the power, also, to not only make use of the foods, but to use up the blood tissue itself. Just how this is done is also a mystery.

There is surely a great lesson in industry here, and one of the most profound studies in economics, physics, and chemistry.

Heat and Energy

The second use of foods, as mentioned before, is to create heat and energy for the work of the body. This includes the action of the heart; the movement of the lungs in breathing; the digestion, absorption, and assimilation of food elements; the tearing down and elimination of waste; and the muscular activity of body movements.

Just as any engine requires fuel, water, and air to create the force necessary to run the machinery, so does the human engine require fuel, air, and water. The fuel for the engine consists of coal, wood, or oil. As these are rapidly brought in combination with oxygen, combustion, or oxidation, takes place, liberating heat and setting the engine in motion. The amount of energy or force given off by an engine exactly equals the amount of latent energy provided in the fuel. Much of this energy is commercially lost, since much of the latent force in fuel is not fully liberated, some, not liberated, going off in the smoke, while some may remain in the cinders.

Just so in the body,—the amount of heat and energy given off from the body exactly equals the amount of latent energy released by material burned during oxidation. It is estimated that about one-sixth

of the heat liberated evaporates through the skin, the lungs, and through the excreta, while five-sixths is required to maintain the body heat.

If the digestive forces are not working perfectly and if the food is not properly cooked, some of the food is not made perfectly soluble for absorption. But in normal conditions, if the food is supplied in proportion to the energy required, the heat and energy given off should exactly equal the latent heat and energy consumed in food.

It is to be noted, also, that no force within the body is lost. In the very process of the removal of waste, heat and energy are created, so that the parts no longer needed are utilized by the system, while they are being removed from it. Here is a lesson in economy of force.

As mentioned before, the fuel for the body consists of *fats, starches, and sugar,* which, in combination with oxygen, create force. The combination of oxygen with other elements in the body is known as oxidation. This oxidation liberates heat and at the same instant produces energy, either in muscle, gland or nerve. The muscular energy expresses itself in muscular motion, the glandular in chemical

action, and the nervous in nervous energy. The nervous energy is closely allied to electrical force.

The *starches* come largely from cereals and root vegetables; the *sugars* largely from cane, from certain trees, and from vegetables, fruit, and milk; the *fats* come from vegetable oils, from animal fat, as fat, and some from milk and butter. Some fats are also formed from proteins.

From the above, it follows that the fuel value of food depends upon the amount of fats, starches, and sugars contained.

The exact process of the conversion of the potential energy latent in food into heat and energy is not known. It is partly released during the digestive process, as the elements of the food come into contact with the oxygen swallowed and with the digestive juices. This combustion gives to the digestive organs the necessary warmth for their effective work. Digestive juices will not flow freely when the body is cold. The heat liberated during the digestive process is necessary, also, to put the elements of the food into condition for absorption, a certain amount of heat being required for the chemical changes. This liberated energy is expressed, not alone in the chemical formation of the compounds,

but in the peristaltic movements of the digestive organs.

A small portion of the heat of the body is gained from the sun or from artificial heat, but by far the greater part is generated within the body. If one is cold, the quickest way to get warm is to generate more heat within by "turning on the draught", or, in other words, by breathing in more oxygen. So many people cover up the body with more clothing to reserve the body heat and forget to generate more heat by arousing the fires within. This is like covering up a dying fire to reserve the heat, instead of turning on the draught to create more combustion.

Nature provides for a reserve of heat and energy, above the immediate needs, by storing up a supply which is called into use whenever the daily supply is inadequate. Many hibernating animals store up sufficient fat in summer to provide heat for the entire winter. This fat would not last the winter, however, were the animal active. Many individuals store up excess of fat sufficient to last them for months, even though all fat building elements be omitted from the diet.

It must be remembered that anything which creates a greater activity of the

tissues, such as muscular exercise, liberates a greater amount of heat. The reverse is also true;—a decrease in the amount of muscular movement means a decrease of heat liberated. During exercise, a large amount of fat, protein, and dextrose (sugar) are released by the movements and oxidized; the liberated heat is carried to all parts of the system and the temperature is raised. Mental work, for the same reason, tends to raise the body temperature, though to a much less degree. Food in the alimentary canal causes an activity in the glands of the digestive organs and also increases the temperature.

Of course, while digestion and mental and muscular activity are at their height, the body temperature is highest. These activities usually reach a maximum in the afternoon and the temperature is then highest, while, as a rule, it decreases from about six at night until four or five in the morning, when it is usually at its lowest ebb. This is a point of importance to physicians. Even five degrees above the average human temperature, if recorded about six at night, is not considered abnormal.

Anything which causes an increase in heat radiation, as perspiration, lowers the temperature, and the open pores of the skin

are valuable aids in equalizing the body heat. A person who perspires freely does not suffer with heat, during excessive exercise, as does one whose pores are closed.

One ready means of regulating the body heat is the *bath*. If one takes a hot bath, the temperature is materially raised by the artificial heat, but there is a recompense in the increase of heat radiation from the skin. If one takes a cold bath, the immediate effect is cooling, but the activity set up within, to create a reaction, soon heats the body to a greater degree than before the bath. The best way to increase the evaporation and thus decrease the temperature of the body is with a tepid shower or a tepid sponge. The tepid water is not so extreme as to create a strong reaction and it will cause a marked decrease in temperature. Thus, for fever patients or for a warm day, the tepid shower or sponge is commended; for a cold day, or for the individual whose circulation is sluggish, the cold bath is desirable. Where the vitality is low, so that there is not sufficient reaction, the bath must be tempered.

Heat generation is also increased by solid foods that require more than normal activity on the part of the glands for diges-

tion. For this reason the food for fever patients should be that most easily digested and should be reduced to the minimum to keep up the strength.

Diuretic foods and beverages, which increase the activity of the skin and the kidneys, also tend to lower the body temperature.

While the elements of the food are being oxidized, the latent (potential) energy released by the oxygen creates mental and physical force and keeps active the metabolic changing of food into tissues and cells, also the changing of cells and tissues into waste.

The young child's blood circulates freely, his breathing is unrestricted, the waste of the system is fully burned up, potential energy is released, and the result is, he must be active. The effort of the teacher, or of those having the care of children should be, not to restrain the child, but rather to direct his activity in advantageous and effective use of his energy.

Scientists have a means of measuring the energy latent in food material, also the amount of heat given off in the oxidation of a given quantity of waste. The unit of measurement is the calorie,—the amount of heat which will raise one pound of water

to four degrees Fahrenheit, or will lift one ton one and fifty-four hundredths.

Truly the body is a busy work-shop. Think of the billions upon billions of cells being formed and destroyed every instant in the liberation of heat and force! Think, also, of the necessity of perfect circulation to bring sufficient blood to the lungs, that it may gather the oxygen and carry it, without pausing for rest, to every tissue of the body! Even in sleep this stream continues incessantly.

There is also a great lesson here in the law of supply and demand;—when the body is at mental or muscular work, the potential energy liberated leaves through muscle or brain, as energy, and is expressed in the result of the work; when the body is at rest, it leaves it as heat (excepting such part as is necessary to carry on metabolism, circulation, etc.) If much muscular energy is called for, a deep, full breath is instinctively drawn to supply the oxygen necessary for the added force required.

If strong mental work is required, attention should be given to exercise and deep breathing the while, that the blood may carry off the waste liberated by brain activity. The difficulty is that in doing close mental work, the body is too frequently

bent over a desk in such a manner as to restrict the action of the lungs; thus, the brain worker, in order to continue strong, mental work, must often go into the open air,—as he says, "to rest his brain", but in reality to re-supply the oxygen required to carry on his work and to carry away the waste liberated by brain energy. The supply for the body work has been called upon for the undue brain work, and this lack of oxygen has produced a state of body designated as "tired." Until the necessary oxygen has been supplied, the brain and body are not balanced, not "rested."

Nothing is lost in Nature's distribution of force and energy. Everything accomplished in life, either in the physical handling of material, the brain work in planning the constructions, the mental movements of thought in art, literature, or science, are all representatives of the heat and energy released from the body, and it is the effort of every man and woman to make the body yield as large an income as possible in the expression of this energy. In order that it may do so, it must be used with intelligence, just as any other great machine must be used intelligently; it must be fed, exercised, and rested judiciously.

Repair and Elimination of Waste (Metabolism)

Every part of the body is constantly changing. Its work never stops. If kept in thorough repair it must be torn down and rebuilt incessantly. These chemical changes are called collectively *metabolism.* They are divided into two groups: the chemical process of building up complex substances from simple ones is known as *anabolism;* the chemical process of oxidizing and breaking down the complex substances into simple ones, so that they are in a state to be excreted, is *catabolism.* While the process of oxidation in catabolism is going on, heat and energy are set free. Most of the chemical changes in the body are catabolic in character. This work of tearing down and rebuilding body tissues never ceases—even in sleep.

It is not enough that the proper foods be furnished the body in kind and quantity. The essential thing is that the system be kept in condition to *assimilate* the foods to its needs and to promptly eliminate the waste. Few people assimilate all of the foods eaten; nearly every one eats more than necessary for the body needs.

By *assimilation* is meant the digestive process by which foodstuffs are made soluble and diffusible, so that they can pass

into the blood; also, the metabolic activity by which the food is converted into cells and tissues.

Nature provides for an incomplete knowledge of the amount of re-supply necessary, by enabling the system to carry off a limited amount of surplus food above the bodily requirements.

The distinct steps in anabolism are discussed in the following chapter describing the work of different organs and the chemical changes of foods as they come in contact with the elements in the digestive juices.

CLASSIFICATION OF FOOD ELEMENTS

By *foodstuff* is meant the chemical elements, appropriated by the animal for the use of the body, as described above. By *foods* is meant those articles of diet found in the market which contain the chemical elements used by the body in various combinations. Bread, for example, contains all of the foodstuffs and has been called the staff of life, because it sustains life. Foods may contain elements, not foodstuffs, and not used by the body, but cast out as waste, while certain foods, such as sugar, corn-starch, olive oil, and egg albumen, contain only one foodstuff, as will be noted in the following classification of foods and foodstuffs—grouped according to the body uses.

There are many classifications but the following tables, as compiled by a leading

dietitian* for his practical work in classes, are clear and concise.

Carbonaceous foods:

Sugars
Starches
Root and tuberous vegetables
Green vegetables
Fruits
Fats

Nitrogenous foods:

Lean meat
Eggs
Gluten

Carbo-nitrogenous foods:

Cereals
Legumes
Nuts
Milk

The above classifications are made because of the preponderance of certain elements in them, not because they do not contain other substances; e. g. vegetables are mixtures of sugars and starches; fruits are mixtures of sugars, vegetable acids, and salts; milk, legumes, cereals, and nuts contain a more equal division of sugars, fats and proteins and are therefore represented as carbo-nitrogenous; lean meats, with the exception of shell

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* Winfield S. Hall, Ph. D., M. D., Prof of Physiology, Northwestern University Medical School, Chicago.

fish, contain no starch, but all meats contain fat, protein, and water, and all, except liver, contain ash.

In the table below, examples are given of foodstuffs in which the chemical elements are almost pure representatives of their classes. Cornstarch, sago, and tapioca are almost pure starch, containing very little of any other element; glucose, cane sugar, syrups, and honey are almost pure sugar; butter, lard, and olive oil are nearly all pure fat; egg albumen, gluten, and lean meat are almost pure protein.

Foodstuffs
- **Inorganic**
  - **Water**
  - **Salts**
- **Organic**
  - **Carbonaceous (producing heat & energy**
    - **Starches**
      - **Corn Starch**
      - **Sago**
      - **Tapioca**
    - **Sugars**
      - **Glucose**
      - **Cane Sugar**
      - **Syrups**
      - **Honey**
    - **Fats**
      - **Lard**
      - **Olive Oil**
      - **Butter**
  - **Nitrogenuous—(growth and repair)**
    - **Proteins**
      - **Egg Albumen**
      - **Gluten**
      - **Lean Meat**

The *proteins* contain nitrogen, sulphur, and phosphates. The predominance of nitrogen has given the proteins the name nitrogenous. The carbonaceous foods

contain none of these elements, but are rich in carbon, hence the name carbonaceous.

As previously stated, no food contains but one element of foodstuffs and all elements are formed into compounds of plant life from the elements in the soil, air and water by the action of the sun's rays. The rays of heat and light seem to store something of their power in latent heat and energy within the combinations of these compounds. The end of plant life is the completion of its compounds,—it first generates the compounds, then matures them, and then dies.

All *organic* matter is thus formed by the action of the sun's rays upon *inorganic* matter. All meats are first in the form of plant life and are converted into other compounds by the chemical processes of the animal. This chemical action of the animal converts the energy latent in the foods into more concentrated form. The animal thus performs a part of the chemical work for man.

The classification of foods, as previously stated, is based upon the principal organic foodstuffs contained. Proteins contain carbon and salts, and carbonaceous foods contain salts and nitrogen, but these are

not in appreciable quantity. The preponderance of these elements determines the use of the foodstuffs in the body. It will be remembered that the chief uses are the production of heat and energy, the building of new tissue of the growing child, and the repair of the waste in the child and the adult.

Water

No one element of food is more important for the needs of the body than water. It comprises about two-thirds of the body weight and is a component part of all foods. It is composed of oxygen and hydrogen.

In order that the body may do efficient work in digestion and in the distribution of the nutrient elements of the foods, and that the evaporations from the body may be re-supplied, the water in the foods, together with the beverages drunk, should consist of about seventy-five per cent liquid to twenty-five per cent nutrient elements, or about three times as much in weight as proteins, fats, and carbohydrates combined. If undue evaporation or perspiration is occasioned, a larger proportion is required.

Water passes directly into the circulation without chemical change. It is being

constantly evaporated through the lungs and the skin, and every forty-five seconds it passes from the kidneys into the bladder.

The average individual at normal exercise, requires about seventy-one and one-half ounces of water daily, which equals about nine glasses (one glass of water weighs one-half pound); a part of this is consumed in the food. By reference to the following tables it will be noted that water forms a large percentage of all food, particularly of green vegetables and fruits.

The importance of water for children must not be overlooked. It is the heat regulator of the body, and the more energy used, either in work or in play, which results in more heat and evaporation, the more water is required. An animal, if warm, immediately seeks water.

The body will subsist for weeks upon the food stored about its tissues; it will even consume the tissues themselves, but it would burn itself up without water, and the thirst after a few days without water almost drives one insane. It should be furnished freely, in small quantities at a time, to fever patients.

Few people, give much thought to its re-supply; yet they suffer from the loss of

it, in imperfect digestion and assimilation, and with kidney and intestinal difficulties, ignorant of the cause.

Water softens and dissolves the food and aids in its absorption; it is one chief agent in increasing the peristaltic action of both the stomach and intestines, thus aiding in mixing the food with the digestive juices and aiding the movement along the alimentary canal; it increases the flow of saliva and of digestive juices and aids these juices in reaching every particle of food more promptly; it aids in the distribution of food materials throughout the body, carrying them in the blood and the lymph from the digestive organs to the tissues, where they are assimilated; it forms a large part of blood and lymph.

The theory has long been held that water drinking at meals is injurious, the objection being that the food is not so thoroughly masticated if washed down with water, and that it dilutes the digestive juices. But this theory is not so strongly held as formerly—in fact, it is now rightly disputed by the best authorities.

When water drinking at meals is allowed to interfere with mastication and is used to wash down the food, the objection is well taken, but one rarely drinks while

food is in the mouth, the water being taken at rest periods between mouthfuls. *Thorough mastication and a consequent free mixing of the food with saliva is one of the most essential steps in digestion,* and the flow of gastric juice, as the flow of saliva, is stimulated by the water.

If, on the other hand, the food is not thoroughly masticated, water is most essential to furnish that which the saliva would otherwise supply to soak up and dissolve the food, in order that the gastric juice may more readily reach all parts of it.

It is singular that the use of water at meals has long been considered unwise when the free use of milk, which is about seven-eighths water has been recommended.

The copious drinking of cool water from a half hour to an hour before a meal will cleanse the stomach and incite the flow of saliva and gastric juice. Moreover, the digestive cells secrete their juices more freely and the sucking villi absorb more readily when the stomach and intestines are moderately full, either of food or water, and to fill the stomach with food requires too much digestion. The water

passes through the stomach before the food.

In building up about seven thousand thin women, results show that the free drinking of liquid at meals has a tendency to put on flesh. Probably one reason for this is because of the cleanliness and greater freedom given to the absorbing and secreting cells of the mucous lining of the digestive tract, as well as to the stronger peristalsis.

It will be noted that water drinking at meals has many more arguments in its favor than against it.

One important use to which water is put is to cleanse the digestive tract and the kidneys. This cleansing within is more necessary than the cleansing of the surface of the body. One cannot form a better habit than that of drinking two to three glasses of water upon first arising and then working the stomach and intestines by a series of exercises which alternately relax and contract their walls, causing a thorough cleansing of these organs.

In case of gastritis, or a catarrhal condition of the stomach, often a pint of slimy mucus will collect in the stomach over night and the cleansing of the mucous lin-

ing of the digestive tract is then most important.

The drinking of warm (not too hot) or cold water in the morning depends upon the condition of the individual. If in good condition, two to three glasses of cold water, the vigorous exercises for the vital organs, and deep breathing of *pure* air, followed by a cold bath, will do more to *keep* the health, vigor, clear skin, and sparkling eye than fortunes spent upon seeking new climates, mineral waters, or tonics. There is no tonic like water, exercise, and fresh air, as above prescribed.

Soft water, that is water containing no lime or other mineral matter, is best for cooking purposes; hard water, which causes any degree of curdling of soap, or a lime crust in the bottom of a tea kettle, is hard on digestion. Bacterial germs are killed and much of the mineral matter deposited by boiling the water. For drinking purposes it should be aerated that it may regain its original, fresh taste, otherwise boiled water tastes flat or insipid. It may be aerated by filling a jar half full of water, leaving the other half for air, and then shaking the water in the jar so that the air passes through it.

Many claim that one's thirst, as in the desire for food, is the only safe guide, as to the amount and time of drinking, but these desires are largely matters of habit, and tastes are often perverted. Unless the condition is abnormal or the mind becomes so intensely active that one fails to listen to the call of nature, the system calls for what *it has been in the habit of receiving* and at the stated times it has been in the habit of receiving it. The safe method is to form the habit of eating and drinking a stipulated amount at regular periods and not allowing this regular habit to be broken, unless, for some cause, the system be out of order, and then the habit should only be broken for a time.

Salt

Milk furnishes salt in proper proportion for the baby, and later, when the child is through nursing, eggs should be added to the diet of cow's milk. It is especially essential that growing children be furnished milk and eggs that they may be assured of the proper proportion and quantity of calcium salts, as these form the substances of bones and teeth, which constitute about one-sixth of the body weight.

All vegetables, fruits, cereals, legumes, and nuts furnish both calcium salts and sodium, potassium, and magnesium, which are the salts used in the blood and lymph. Minerals are abundant in dried legumes, (beans and peas). A diet consisting largely of vegetables needs the addition of sodium chlorid (common table salt) to supply sufficient salts for foods; likewise more salt than is contained in grass and fodder is needed for animals, particularly for those producing milk. The scientific farmer salts his cattle regularly, while wild animals travel miles and form beaten paths to springs containing salt.

In rectal feeding, it is known that food absorbs more readily through the large intestine if salted. It is probable that salt, in normal proportions, also aids absorption in the stomach and small intestine.

Salt should not, however, be used immoderately.

The minerals of the food, or of the body, form the ashes in burning.

Iron

Iron is an inorganic substance and is necessary in making red blood corpuscles.

If, by some disturbance in the digestion, absorption, or assimilation of food, more

iron is excreted from the body than is made use of from the food, the blood making organs do not receive sufficient iron and the blood is lacking in red corpuscles. It becomes poor in hemogloblin and the individual becomes pale. This condition is known as *Anaemia.*

Where there are not sufficient red blood corpuscles, it is of vital importance that one keep up a good circulation; the stomach, intestines, liver, and spleen must be strengthened through exercise and one must breathe deeply of pure air, for the red blood corpuscles are oxygen carriers, and the insufficient supply must do double duty or the waste of the system will not be oxidized and eliminated.

A diet rich in iron must be supplied. It will most often be found that one whose blood is lacking in hemoglobin and in the proper proportion of red blood corpuscles, has had a dislike for the foods rich in iron, or, perhaps, has not been able to get the right kind of food.

The yolks of eggs, the red meats (such as steak, mutton or the breast of wild game), and the deep colored greens, (such as spinach, chard, dandelions, etc.) contain a goodly proportion of iron. The dark color of greens and of the dark meats

is given to them by the iron which they contain. The dark leaves of lettuce, celery, and cabbage contain iron, but these vegetables are apt to be bleached before being put upon the market.

The yolks of two eggs are better than one whole egg, as the iron is in the yolk. A good way to take the yolk of eggs is in egg lemonade or in egg-nog, with a little nutmeg for spice.

Carbonaceous Foodstuffs

The carbonaceous foods are those used by the body for heat and energy and are so named because they contain a large proportion of carbon,—heat producing element. It is the carbon in wood, which, uniting with oxygen, produces heat and light.

The carbonaceous foods are all composed of carbon, hydrogen, and oxygen, the difference being in the different proportions in which these elements are combined.

They are divided into two classes, Fats and Carbohydrates. The carbohydrates

embrace the sugars and starches and include such substances as the starches of vegetables and grains (notably corn, rice, wheat, and the root vegetables), and the sugar of milk, of fruits, vegetables, and the sap of trees. Their chief office is to create energy. They are almost entirely absent from meat and eggs, the animal having converted them into fats.

Carbohydrates are easily digested.

Fat

Fat is the most concentrated form of fuel and is readily oxidized. It is almost pure carbon, hence less chemical work is required to convert it into fuel, but more oxygen is needed. A pound of fat has about three times as much fuel value as a pound of wheat flour, which consists largely of starch.

Fat forms about fifteen per cent of the weight of the normal body, and it has about twice the fuel value of carbohydrates.

Carbohydrates and fats are each composed of carbon, hydrogen, and oxygen, the difference being that there is less oxygen in fat, hence, more oxygen from the air is required for combustion of fat than for carbohydrates. One pound of starch requires one and one-fifth pounds of oxygen for perfect combustion, while one

pound of suet requires three pounds of oxygen. For this reason the Eskimo, who depends largely upon the fats for body heat and energy, must have plenty of fresh air. One ounce of fat yields two and one-half times as much energy as an ounce of sugar or starch.

If sufficient fat is not consumed, or is not formed from the carbohydrates (starches and sugars), a certain portion of the protein of the body is converted into fat and used in energy. When the food supply is short, or much energy is called for, the surplus supply of carbohydrates is first used, and, if the carbohydrates are not sufficient, the proteins are used. Of the proteins, the gelatinoids are used first, and next the albuminoids, or tissue builders. If the demand, either in mental or physical energy, exceeds the daily supply for a length of time, the body becomes lean.

In warm weather little fat is needed for fuel and nature provides fresh, green vegetables to replace the root vegetables of the winter, which, consisting largely of starches and sugars, are readily converted into heat. In cold weather, especially in high altitudes or latitudes, more fuel foods are required to keep the body warm and more fat is eaten in winter.

Those who store up an abundance of fat suffer most from a rise in temperature, because combustion not only creates heat, but heat also aids combustion.

Fats are not digested in the stomach. The connective tissue about the fat is digested here, and the fat is passed on into the small intestine, where it is acted upon by the carbonates and by lipase, one of the enzymes of the intestinal juices. These first change the fat into an emulsion and then into a form of soap and glycerine. In this saponified form, it is in condition to be absorbed into the circulation and carried out to the tissues, where it is assimilated and used in energy; a similar chemical change is produced in the convertion of oil into soap.

Common examples of fats are butter, cream, the fat of meats and of nuts, and the oil of grains and seeds,—notably the cocoanut, olive, and, of the grains, oatmeal.

The fact that more oxygen is required for combustion of fat than of starches and sugars is an important item for those who wish to call upon the fats stored within the body for daily heat and energy and thus reduce in weight. If sufficient starches, sugars, and fats are not consumed in the

food to supply the daily heat and energy released by exercise, the body calls upon the sugars and starches temporarily stored up and, when these have been consumed, upon the reserve of fat. If much fat is consumed in the daily food this fat in the blood will be oxidized before the fat stored about the muscular tissue. The scientific reduction of weight, therefore, lies in the regulation of the supply of starches, sugars, and fats consumed, and, the oxidation of more of these substances through an increase in the daily exercise. Deep breathing of pure air should accompany all exercises, to supply sufficient oxygen for combustion, or oxidation.

Manual laborers require more fat for energy than do people whose habits are sedentary. School children, or children who play hard, should have sufficient fat, and where fats are withheld, sugar should be freely supplied.

The supply of fat stored in the body depends upon the quantity consumed with the food, upon the quantity used up in heat and energy, in muscular exercise, or in mental force. The quantity thus consumed depends somewhat upon the condition of the nerves. If the nerves are weak, they do not properly direct digestion and

assimilation and less fat is consumed in the digestive and assimilative processes.

Butter and Cream. The fat present in milk depends, of course, upon the quality of the milk. There is as much butter fat in a glass of fresh Jersey milk as in a glass of cream, which has been separated, by machinery, from the milk of some other cows. The cream from some Jersey cows is almost all butter. Skimmed milk contains very little fat. If milk is drunk by the adult, as a means of storing up more fat within the body, the cream should be stirred into it.

The Fat of Meat should be thoroughly cooked and cooked with moisture. All meats in the process of baking or frying should be covered, in order to retain the moisture. To make fat easily digestible it should be well masticated.

Bacon, if fully immersed in its own grease, in the process of frying, is a common source of fat and is easily digested.

Cod Liver Oil from the liver of the codfish, is more easily absorbed and assimilated than any other fat. The odor is not pleasant and a little lemon juice, salt, baking soda, or any substance for pungency and flavor, may be added to make it palatable. The pure oil taken in this way is

perhaps preferable to the prepared emulsions. One has the advantage, at least, of knowing what he is taking.

Olive Oil is crushed from ripe olives. It is often used where cod liver oil is prescribed, because more palatable. Cotton seed oil is often substituted or mixed with the cheaper grades of olive oil. It is wholesome, if fresh, but has not the pleasing flavor of the olive.

Many take olive oil for the purpose of rounding out the figure with fat. If the system will assimilate fat, taken in quantities, the fat may be stored up, but, as a rule, one is underweight because of a failure to assimilate the regular diet and the overloading with fat would not cause a better assimilation.

Olive oil in moderation is a good food where much heat and energy are expended, but if ones occupation is sedentary, much fat is not required.

Nut Oils are good, but, with the exception of peanut butter, are not often used.

Sugar

The sugars are cane and beet sugar, maple sugar, and glucose.

All sugars are carbohydrates,—carbon, hydrogen, and oxygen,—the oxygen and hydrogen being in the same proportions as

in water, (two atoms of hydrogen and one of oxygen), the difference is that the carbon is missing from the water.

Sugar is said to consist of about ninety-five per cent nutritive value.

Glucose is made by converting the starch in corn into sugar. It is pure, wholesome, and cheap, and, for this reason, it is often used to dilute other sugars. It is not as sweet as other sugars, and it ferments more readily. Many of the syrups on the market are made from it.

The common, granulated sugars are made from sugar cane or beets; beet sugar is becoming more generally used.

Brown sugar is granulated sugar in the early stages of refinement.

Maple sugar is obtained by boiling down the sap of the maple tree. It is often adulterated with other sugars or with glucose, because they are cheaper. This adulteration does not make it unwholesome, but when mixed with these it loses its distinct, maple taste and is more mild.

Before sugar can be used by the human system, it is changed into grape sugar, or dextrose, (another form of sugar) by a ferment in the small intestine called lactose. Milk sugar needs less chemical change

than other sugars and is taken almost at once into the circulation.

When an excess of sugar is consumed, it is stored within the body as glycogen, until required.

Sugar is perhaps a better food than starch, because less force is required for its digestion and it is easily assimilated, being more readily converted into dextrose than are starches. Moreover it furnishes the needed heat and energy to organisms that have no power to digest starch. Milk sugar is a part of the natural food for the infant, because the infant has not developed the ferment necessary for starch digestion.

Sugar may be oxidized within a few minutes after eating, and, for this reason, it is eaten by those who require to use an undue amount of muscular strength. It yields heat and energy within thirty minutes after eating and, in times of great exertion or exhausting labor, the rapidity with which it is assimilated gives it advantage over starch. Used in limited quantities, therefore, according to the muscular or brain power exercised, sugar is one of the best foods for the production of energy. Where much sugar is eaten less starch is required.

It is also said to prevent fatigue, a man being able to do seventy-five per cent more muscular work with less fatigue after consuming about seventeen and one-half ounces of sugar dissolved in pure water.

It might be inferred from the above, that starches could be discarded and replaced by sugars, but a small quantity of sugar soon surfeits the appetite and if the foods were confined to those with a surplus of sugars, sufficient food would not be eaten for the needs of the body. This lack of appetite, occasioned by an excess of sugars, is due, partly, to the fact that the gastric juice is not secreted as freely when there is much sugar in the stomach.

Because of the slower secretion of gastric juice and the surfeit of the appetite, sweetened foods are not used at the beginning of a meal, and, while a moderate amount of sugar is desirable, a surfeit is to be deplored.

While sugar is not converted into fat, it is so readily oxidized and thus supplies heat and energy so promptly that the starches and fats are not called upon until the latent energy in the sugar is used. Those who wish to reduce in flesh should eat it sparingly that the starches and fats may be called upon to furnish energy, but

sugar should be as freely used as the system can handle it, by those who wish to build up in flesh.

Broadly speaking, about one-fourth of a pound of sugar, daily, in connection with other foods, is well utilized by the system, the quantity depending upon whether one leads an active or a sedentary life.

Candy is often made from glucose instead of molasses or cane sugar, and while glucose is wholesome, it undergoes fermentation readily. Much candy, unless one is actively exercising, tends to indigestion.

The desire of the child for sweets is a natural one, because it uses so much energy, and sugar supplies this energy with less effort of the digestive system. When the child begins to eat more solid foods, if sugar is used in abundance for sweetening, it is no longer attracted by the mild sweetness of fresh milk, and it is well to cut down the allowance of sugar, when the child turns against milk, in the hope of restoring the taste for this valuable food. Many of the best authorities state that the child, up to its third year, should never be allowed to taste sweets, in order that the appetite may not be perverted from the natural sweets of milk.

Sugar is better supplied the child in a lump or in home-made candy, rather than in the sweetening of porridge, oatmeal, or bread and milk, etc.

Sweet fruits, fully ripened, contain much sugar and should be freely given to the child. The natural flavor of fruits and grains is very largely destroyed by sugar, which is used too freely on many articles of diet.

Most vegetables and fruits contain sugar,—indeed sugar is the only nutriment in many fruits. The sweet taste in all fruits and vegetables is due to its presence. Sweet potatoes, beets, carrots, parsnips, turnips, grapes, figs, and dates are especially rich in sugar and when these are furnished with a meal, in any appreciable quantity, the starches should be restricted —notably bread, potatoes and rice.

Harvesters, road-makers and others, who do hard work in the open air, can consume large quantities of sugar in pie, pastry, etc., which are difficult to digest, while one who lives an indoor life, should refrain from an undue indulgence in these.

For one who is under-nourished, sugar is a desirable food, if the starch be diminished in proportion as the amount of sugar is increased; but the inclination in sweet-

ening foods is to take more starch than the system requires, since it is the carbohydrate foods which are ordinarily sweetened,—not the proteins.

On account of the latent heat and energy, sugars are more desirable in cold weather than in warm. Nature supplies them more abundantly in root vegetables for this season. More puddings and heavier desserts are eaten in winter.

Starch

Starch is one of the most important carbohydrates used for nutrition. It is formed by the chemical action produced by the sun's rays upon the cells of living plants, from the carbon-dioxide and water in the air and in the soil.

Corn starch, sago, tapioca, and arrowroot are practically pure starch. Cornstarch is from young maturing corn; tapioca is from the meal of a tropical plant, cassava; sago is from the pith of the sago palm; arrowroot is from a plant of the same name, a native of the West Indies. Rice is almost pure starch, while wheat and other cereals contain from sixty to seventy per cent.

Starch lacks flavor and for this reason all starchy foods are seasoned.

All starches must undergo much chemical change by action of the saliva, the intestinal juice and by the liver, before they can be used by the body. They are first converted into dextrine and then into maltose (animal sugar). The digestion is begun by the saliva in the mouth and continued in the stomach by the saliva swallowed with the food. If the saliva fails to digest all of the starch, either in the mouth or the stomach, it passes unchanged into the intestines, where it is converted by the amylase of the intestinal juice, first into dextrine and then into maltose, or sugar. It is absorbed into the blood as sugar. After the digested starch (maltose) passes into the blood it is spoken of as sugar. Before it is converted into energy it is again changed in the liver into animal starch (glycogen) and stored for a time in the liver. When the system is ready for it, it is again broken down into sugar, because in the form of glycogen it cannot be absorbed into the blood.

The chemical process used in the formation of glucose, from the starch in corn, is allied to the change in the liver, from starch into sugar.

The starches and sugars are really the "reserves" or "go-betweens" of the body, being stored until needed.

If starches are consumed in unduly large quantities, without sufficient exercise to burn them up, they overload the liver and clog the system.

Starchy foods should not be given to children before the starch converting ferments are formed, nor to one in disease where these ferments are interrupted.

Nitrogenous Foodstuffs or Proteins

The proteins form heat and energy when the supply of sugars, starches, and fat are exhausted, but proteins, alone form muscle, bone and sinew. They are, in this sense, the most important of foods,—they are, also, the most costly.

The foods most rich in proteins are meat and eggs. These have undergone chemical changes from the vegetable kingdom being built up into more complex compounds in the animal kingdom.

Meat and eggs are the tissue builders. In this connection it may be well to state that blood is tissue; thus meat and eggs build the blood, as well as muscle and sinew.

Nitrogenous foods, or proteins, are so called because of the large proportion of nitrogen which they contain. All nitrogenous foods contain considerable carbon —mostly in the form of fat in the meat elements—but the carbonaceous foods contain so little of the proteins that they do not appreciably enter into the nutrition,—the carbon and nitrogen in the carbo-nitrogenous foods are more equally divided.

The nitrogenous or protein elements in the body constitute about one-fifth of its weight. They make the framework, forming the basis of blood, lymph, muscle, sinew, bone, skin, cartilage, and other tissues.

Worn out body tissues is constantly being torn down and eliminated and the protein in the foods must daily furnish material for repair, as well as for building new tissue in the growing child.

A young animal's first need is for growth, not having learned to exercise sufficiently to use much energy, and the first food given is an animal product—milk to

babes and other mammals, while the young of other animals are first fed upon eggs.

The nitrogenous foods are required in smaller bulk than vegetables and fruits; they are more concentrated and contain less waste. According to recent experiments, the average adult requires from two to four ounces a day of nitrogenous foods, to repair the waste, according to the proportion of nitrogen contained. Happily, where more is consumed, the system has the power, up to a certain limit (depending upon the physical condition and the daily activity), to eliminate an excess. It is needless to say that if the daily waste is not resupplied, the digestion and bodily nutrition suffer. The system *must* have the two to four ounces to supply the nitrogen daily excreted, or the tissues themselves will be consumed.

The proteins, of which meat is the principal one, are classified as

Albuminoids:—albumin (white of eggs), casein (curd of milk), myosin (the basis of lean meat and gluten of wheat),

Gelatinoids, (connective tissue of meat),

Extractives (appetizing and flavoring elements).

DIGESTION

Any discussion in regard to the digestibility of foods must be general, because food which agrees with one may disagree with another, and a food which disagrees with one at a particular time may entirely agree with him at some other time; therefore, before one passes upon the adaptability of a food to the individual, it should be known that this food agrees or disagrees with him under varying conditions.

The digestibility of food depends largely upon the physical condition of the individual, because the amount of digestive juices poured into the alimentary canal is influenced by this condition, particularly by the condition of the nerves. If sufficient juices, in proper proportions, are not poured into the digestive tract, the foodstuffs are not made soluble for absorption into the blood. Digestion is practically synonymous with solution,—all solid foods must be reduced to a liquid state, through

digestive juices and water, before they can pass through the walls of the stomach and intestines.

Each individual should *learn to like* the foods containing the nutrient elements which experience and blood tests have shown to be lacking in his case. The question of likes and of dislikes in regard to foods, is largely habit, and one can learn to like almost any food one wishes.

Where one forms the habit of discriminating too much in the food, or discarding this food or that, because at some time it has disagreed, due to the particular condition at the time, the mind approaches the table as a more or less pessimistic censor and the saliva and the gastric juices are retarded in their flow.

When one is exercising freely, so that the muscular and mucous coats of the digestive system are strong, the body will handle foods which, during sedentary habits, it would not digest. There are kinds of foods, however, which, to certain individuals, according to the chemical composition of the body, act as actual poisons, e. g., strawberries, cheese, or coffee.

It may be well to here trace, briefly, the progress of the food through the digestive

tract and the action of the juices and the ferments upon it.*

Salivary Digestion The food in the mouth is mixed with saliva, which dissolves the starches, converting them into sugar. The starches are the only foods whose chemical digestion is begun in the mouth. They are first broken up into dextrin and then into the more simple sugar, known as animal starch, or *maltose*. Hereafter, in speaking of sugar, after it has been absorbed into the blood, the reader will bear in mind that the term refers not only to digested sugar, consumed as such, but also to digested starches (maltose), as shown on page 63.

It is important that sufficient saliva be mixed with the food, through mastication, that it may enter the stomach and there continue the chemical process of digestion of starch. If starches are not thoroughly masticated, sufficient saliva will not enter the stomach to convert the starch into sugar; the food will pass into the small intestine, which must then do more than its normal work of digestion.

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* A knowledge of the mucous lining of the stomach and intestines, and of the tributary glands, such as the liver and pancreas, is important to a thorough understanding of digestion, and the reader is referred to "The Vital Organs: Their Use and Abuse" of this series. This takes up the study of the secretion of digestive juices, the conditions favoring normal secretions, etc.

The saliva consists of about ninety-nine and one-half per cent water and one-half per cent solids. The solids consist of ptyalin, sodium chlorid, sodium carbonate (baking soda), mucus, and epithelium. Ptyalin, the most important of these, is an active digestive agent; the mucus lubricates the masticated food; the sodium carbonate insures the alkalinity of the food; the salt is present in all secretions; and the water dissolves the food that the juices may more readily reach and act upon each particle.

The saliva flows into the mouth, more or less, at all times, but more copiously during mastication. Its evident purpose, when food is not present, is to keep the lining of the mouth moist.

The flow of saliva is controlled, to a great degree, by nerves which have their centers in the medulla oblongata. The sight of food, pleasingly served, or even the thought of food which one likes, will increase the salivary flow. This is one instance of the control of thought materially affecting digestion, and the importance of *forming the habit of cultivating a taste for all kinds of .food,* is apparent. The stronger the relish for the food, and the more thoroughly it is masticated, and

mixed with the saliva, the more perfect will be the first step in digestion. This first step of thorough mastication is all important, not only because the chemical action upon the starch molecules is facilitated by the thorough softening and mixing with the saliva, but thorough mastication also tends to prevent over-eating.

Water encourages the flow of saliva and for this reason should be drunk copiously before meals, particularly where digestion is weak. It may also be taken at rest periods during the meal. (See page 44).

Stomach Digestion As the food enters the stomach, the gastric juice pours out from the mucous lining, very much as the saliva pours into the mouth. It consists of ninety-nine and one-half per cent water and one-half per cent solids, as does the saliva. The solids of the gastric juice are composed of pepsin, rennin, hydrochloric acid, and mucus. The mucus serves to lubricate the food as in the saliva. It also prevents the digestion of the mucous lining of the stomach itself.

The hydrochloric acid and the pepsin cause the principal chemical changes in the food while in the stomach, acting alone upon the proteins. The only digestion of

starches in the stomach is that continued by the saliva. The salivary digestion proceeds until the gastric juice is secreted in sufficient quantity to cause a marked acidity of the stomach contents, when the starches are passed into the intestines.

Gastric juice begins to flow into the stomach soon after eating, but it is not secreted in sufficient quantity to supersede salivary digestion for from twenty to forty-five minutes.

The result of gastric digestion of proteins is their conversion, first, into albumin, then into proteosis and, lastly, into peptone, which is protein in a more simple, soluble, and diffusible form. In the form of peptone, the proteins are in condition to be absorbed.

If the food has been properly cooked and masticated the gastric digestion will be completed in one and one-half to three hours. If not properly cooked and masticated, the stomach digestion may continue one to two hours longer. It should, however, be completed in three hours.

The most readily digested animal foods remain less time in the stomach. Meat, as a rule, is easily digested, because the action of the digestive juices of the animal has converted the starches and

sugars. The white meat of chicken, being soft, is digested in a shorter time than the red or the dark meat.

Fluids leave the stomach more rapidly than solids. Seven ounces of water leave the stomach in one and one-half hours, seven ounces of boiled milk in about two hours.

The flow of gastric juice, as the flow of saliva, is governed by the nerves;—the sight, taste, and smell of food, and the attitude of mind toward it, to a certain extent, regulates its flow.

After the food has extensively accumulated, during the progress of a meal, the stomach begins a series of wave-like movements called peristaltic waves.* These waves work downward through the length of the stomach towards its lower opening, known as the pyloric orifice. As the food is moved down the stomach by these motions, it is thoroughly mixed with the gastric juice.

During the early stages of digestion, the sphincter muscles of the pylorus keep the lower end of the stomach closed, but, as digestion progresses, the pylorus gradually relaxes to let the digested,

* See "The Vital Organs; Their Use and Abuse" by Susanna Cocroft.

soluble portion of the food pass into the intestine. If the food still remains in a solid form, by reason of being improperly cooked or poorly masticated, as it touches the pylorus, these sphincter muscles, almost as if they were endowed with reasoning faculties, close, forcing the undigested mass back to be further acted upon by the gastric juice,—the solid mass is not allowed to pass until dissolved.

If the individual continues to abuse the stomach and to cause it to work overtime, it becomes exhausted and demands rest; it refuses to discharge the gastric juice in proper proportion; the peristaltic movements are weak; and food is not promptly or forcefully moved along the stomach and mixed with the gastric juice. This demand for a rest is termed *Indigestion.*

To sum up,—digested sugar is dextrose; digested starch is first dextrin, then maltose (animal, sugar); digested protein is peptone; and, digested fat is saponified fat.

Intestinal Digestion The food passes from the stomach, through the pylorus into the small intestine. The first twelve inches of the small intestine is known as the duodenum. In the duodenum it is acted upon by

the pancreatic juice from the pancreas, the bile from the liver, and the intestinal juices. These juices act upon proteins, fats, and carbohydrates. The bile acts upon the fats, while the pancreatic and intestinal juices act chiefly upon the carbohydrates.

As the food enters the intestine, it is changed, by the sodium carbonate, from the acid condition produced in the stomach, to alkaline reaction.

The bile exercises an important influence upon digestion, any disturbance in the flow of this greenish-brown secretion being very quickly shown both in stomach and intestinal digestion. It emulsonizes and saponifies the fats, it aids in their absorption, and it lubricates the intestinal mass, facilitating its passage through the entire length of the intestines. Thus, it is a very potent agent in regulating the bowel movements. A diminution in the flow of bile quickly expresses itself in constipation.

Fats are almost entirely digested in the small intestine. The presence of fat stimulates the flow of pancreatic juice, which, in turn, stimulates the flow of bile from the liver. For this reason, if the liver is sluggish, fatty foods are desirable. Olive oil is prescribed for gall stones to stimulate the action of the bile ducts.

Before the fat molecules can be absorbed, they must first be broken up into glycerin and fatty acids and further changed to a fine emulsion, which gives the contents of the small intestine a milky appearance. After they are broken up into these fatty acids and thus brought to the finest state of emulsion, they are readily saponified, being then soluble in water and in a state to be absorbed by the walls of the intestines. The fats are absorbed almost entirely in the small intestine,—mostly in the duodenum.

As a rule, the starches, or dextrin, will not be fully digested by the saliva and those which have failed of salivary digestion are acted upon by amylase (one of the solids of the intestinal juice) and changed to maltose, while the trypsin from the pancreas, together with the intestinal juice, acts upon any protein which has failed to be fully digested in the stomach, changing it into peptone. In the form or peptone it is absorbed through the "sucking" villi of the intestinal walls.

The food is forced along the intestinal tract by peristaltic or muscular relaxation and contraction waves, as in the stomach. As it is so forced, the nutrient elements, after being put into condition for absorp-

tion, are taken up through the villi of the intestinal walls by the portal veins and the lacteals of the sub-mucous lining. (See page 78).

It is now believed that a larger proportion of food is digested and absorbed than was heretofore realized, and that the excretions from the intestines are, in many cases, made up almost entirely of refuse, and of the catabolic waste of the system. In an ordinary, mixed diet, it is stated that about ninety-two per cent of the proteins, ninety-five per cent of the fats, and ninety-seven per cent of the carbohydrates are retained by the body.

In digestion, it is of the utmost importance that the muscular, mucous, and the sub-mucous coats, and the secreting glands of the stomach and intestines be kept thoroughly strong and active, that the digestive juices may be freely poured out, the nutriment be freely absorbed, and the food be moved along the digestive tract. The strength of any organ is gained through the nutriment in the blood; therefore, daily exercise, which calls the blood freely to these organs, is imperative.

Absorption of Food The greater part of the food is absorbed through the intestines, yet some proteins, which have been fully digested by the gastric juice, and certain fats, particularly the fats in milk, which are in a natural state of emulsion, may be absorbed through the walls of the stomach. However, the absorption through the stomach is small compared to that through the intestines.

The small intestine is particularly fitted for absorption. Every inch or so along its course the mucous lining is thrown up into folds, as if to catch the food as it passes toward the large intestine, and to hold it there until the villi have the opportunity to absorb it. These transverse folds of the intestinal walls are called valvulæ conniventes. The villi are fingerlike projections of the mucous lining of the intestines, which stand out upon the lining somewhat as the nap on plush. They have been called "sucking" villi, because during the movements of the intestines they seem to suck in the liquid food. As soon as the foodstuffs,—proteins, carbohydrates, and fats, are put in a dissoluble state ready for absorption, they are very promptly absorbed by the villi. If, for

any reason, they remain unabsorbed, they are liable to ferment by the action of the trypsin, or to be attacked by the bacteria always present in the intestines.

The peptones, sugars, and saponified fats are rapidly absorbed, while the undigested portion, together with the unabsorbed water, the bile, mucus and bacterial products, are passed through the ileo-cecal valve into the large intestine.

That the large intestine is also adapted to the absorption of fats is shown by clinical experiments with patients who cannot retain food in the stomach, the food in such cases being given through rectal injections.

In the large intestine, the mass passes up the ascending colon, across the transverse colon, and down the descending colon, losing, by absorption, foodstuffs not absorbed in the stomach and small intestine.

While water and salt are absorbed both in the stomach and in the small intestine, the evident purpose in leaving the larger part of the water to be absorbed in the large intestine is that it may assist the intestinal contents in passing along. The water also stimulates the peristaltic movement.

As the food is absorbed through the walls of the alimentary canal, it is picked up by the rootlets of the mesenteric veins* and by the lymph channels,—the latter, through the abdominal cavity, are called lacteals. Nearly all of the fats are absorbed through the lacteals. The whitish color given to the contents of the lacteals, by the saponified fats, gives rise to the term lacteal, meaning "whitish."

Nearly all of the proteins and sugars pass through the mesenteric veins and the portal veins into the liver. Here the sugars are at once attacked by the liver cells and built up into glycogen as described on page 81 and the proteins are passed through the liver into the arterial blood stream. A small portion of the proteins, however, do not go to the liver, but are passed directly into the lymphatics and thus into the blood stream, where they are again carried to the liver.

To sum up,—the larger part of the absorption of sugars, starches, proteins, and fats is through the small intestine, though some are absorbed in the stomach and a very little through the large intestine; while some water and salts are absorbed

* For illustration see the frontispiece of "The Circulation, Lungs, Heart," of this series.

in the stomach and small intestine, these are largely absorbed in the large intestine.

The Work of Various Organs Affecting Digestion

The purpose of this chapter is to show the work of other organs than the digestive organs in converting the digested food to use in the body, in tearing down waste, and in eliminating waste and an excess of material above the body needs.

Work of the Liver

The liver is commonly called the chemical work-shop of the body. The proteins and sugars are carried through the blood (portal veins) to the liver directly they are absorbed from the alimentary canal. As the food materials filter through the blood capillaries, between the liver cells, several substances are absorbed, particularly sugar, which is here changed into animal starch called *glycogen*. It is held in the liver for a few hours in the form of glycogen and then redigested by the action of an amylolitic ferment and

again gradually given out into the blood in the form of sugar; hence sugar is subject first to the anabolic change of being built up into glycogen, and then to the catabolic change of oxidation and breaking down.

While the conversion of the sugar is one chief office of the liver, it also acts upon the proteins,—not as they are first passed through the liver in the blood, but as they are returned to the liver from the muscle tissue, partly oxidized and broken up into simpler products. The liver cells absorb and further oxidize and combine them into nitrogenous waste, which the kidneys throw off in urea.

The liver and the spleen also break up the pigment or coloring matter of the red blood corpuscles. As they become worn out, they are retired in the liver and the spleen from the circulation. The iron is retained by the liver cells and the remainder is thrown off from the liver, in the bile.

The liver is often called the watch dog of the body, because it is on guard for all poisons which pass through it in the blood. The large part of these toxic substances are absorbed through the alimentary canal with other foodstuffs. Many of them are the result of the fermentation of foods

which are not digested as promptly as they should be, on account of an insufficient secretion of digestive juices, or a failure to secrete them in normal proportions, or due to inactivity of the stomach and intestines.

It surely is a wise provision of nature to supply a guard to oxidize, or break down these poisons and make them harmless, so that they do not pass to all parts of the body as poisons, thus affecting the nerves and the blood stream, and, through these, the entire system.

The necessity of correct habits of deep breathing will be readily seen, because oxygen is required to break down the poisons as well as to oxidize the waste of the system.

One example of the action of the liver in rendering substances harmless, is its oxidation of alcohol. From one to three ounces of alcohol a day are oxidized and made harmless in the liver, varying according to the individual and to the condition, at different times, in the same person. If the limit of one to three ounces is exceeded, the excess is not oxidized and intoxication results. These evidences of intoxication are in the nature of narcosis; *alcohol is now regarded as a narcotic along with ether and chloroform.*

It was formerly held by physiologists that alcohol was a food, because its oxidation liberates body heat and it was assumed that this liberation of heat, was the same as that freed by the combustion of fats, starches, and sugar uniting with oxygen. More recent knowledge, however, has unquestionably determined that heat, resulting from oxidation of alcohol, does not keep up body temperature; the pores of the skin are opened and there is a greater loss of heat through the skin. This really makes the system less able to resist cold. Large doses of alcohol actually cause a fall in body temperature and every force of the body is decreased in efficiency, while if alcohol were an actual food the efficiency would be increased. We are forced to the conclusion, therefore, that alcohol is a *pseudo-food* as it is a *pseudo-stimulant.*

Work of the Muscles

The muscles play an important part in the use of foods. Most of the heat is generated in them, by the sugar and fats coming in contact with the oxygen in the blood. This heat is liberated during every moment of the twenty-four hours, asleep or awake. Of course, more is liberated during exercise, since the movement of the muscles sets all tissues

into activity and the blood circulates more strongly, bringing a greater supply of oxygen to them. It is always well during active exercise to stop frequently and fully inflate the lungs. The effort should always be made to breathe fully and deeply—otherwise the pressure of the liberated carbon dioxid will cause a pressure throughout the blood stream, particularly about the heart and in the head. This pressure is relieved when the excess of carbonic acid gas liberated has been thrown off by the lungs. Nature makes the effort to throw off the excess of carbonic acid gas by forcing one to breath more rapidly while running or taking unusual exercise.

The oxidation changes are simply a combustion of sugars and fats, liberating latent heat as they are brought into contact with the oxygen. Exercise and a regulation of the amount of carbohydrates and fats consumed in the foods is the natural, scientific method for the reduction of an excess of fat.

A certain amount of protein is constantly oxidized in the muscles, also, being broken down into carbon dioxid, water and a number of nitrogenous mid-products.

The carbonic acid gas and water are thrown off by the lungs and the partially oxidized, nitrogenous waste is carried to the liver, where it is further oxidized and prepared for excretion, through the kidneys, lungs, skin and intestines.

When sugar is carried to the muscles in larger quantities than can be utilized by them, it is often built up into animal starch and stored in the form of glycogen, similar to its chemical change and storage in the liver.

This storage of glycogen in the muscles and in the liver is a wise provision of Nature. It is a reserve to be called upon whenever the expenditure of heat and energy exceeds the amount supplied in any day's rations.

Work of the Nerves

The nerves oxidize food materials, but not to any great extent, excepting during nervous activity. During periods of rest, food materials are stored in the nerve cells in grandular form. They represent concentrated nerve foods and are the result of anabolic processes. During nervous activity they are oxidized and carried away through the blood and the lymph. This oxidation of the food,

stored in the nerves, creates nervous energy and heat.

The energy liberated by the nerves resembles electrical energy.

Where one subjects himself continuously to an excess of nervous activity, all reserve food material, stored in the nerve cells, is used and the result is a trying nerve tension. Such individuals need plenty of easily digested food.

Work of the Lungs

The lungs absorb oxygen and eliminate carbon dioxid. They occasionally throw off a very little organic material.

The carbon dioxid is carried to the lungs from the tissues through the venous stream and diffused through the capillary walls of the lungs. The oxygen is absorbed into the capillaries through the thin air sacs in the walls of the lungs.

Work of the Kidneys

The kidneys do not absorb as do the lungs, neither do they perform any anabolic work as does the liver, nor catabolic work as the muscles, nerves and the liver. They simply throw off waste matter.

The blood passes through them in a transverse branch from the abdominal

aorta. In its circuit urea, uric acid, urates, sulphuric acid, sulphates and sodium phosphates pass from the blood with the water and are thrown from the system; hence the kidneys are purifying organs, as are the lungs. The blood returning from the kidneys through the veins is pure, just as the blood in the pulmonary vein is pure, while that in the arteries to the kidneys and the lungs is impure.

The above substances cannot be thrown off from the lungs. They are the products of oxidation of proteins, partly of the living tissues and partly those broken down direct as they are supplied in the foods, in excess of the needs of the system.

Interference in the action of the kidneys results in a hoarding of these substances in the blood, and may produce an intoxicated condition known as uremic poisoning.

Water in abundance and diuretic fruits and vegetables, which increase the activity of the kidneys, should be taken where uremia is indicated. (Foods which cause a free flow of urine are called diuretic foods.)

Work of the Skin

The sweat glands also throw off an excess of water and salts. The kidneys and the skin are interdependent; if the kidneys are inactive the skin throws off a larger quantity and if the skin is inactive, or if for any reason the pores of the skin are closed, the kidneys are more active. This is evidenced by the sudden immersion of the body in cold water; the pores of the skin being closed the kidneys immediately act.

During the summer, or at any time when the skin throws off more water than usual, the kidneys are less active and the urine, being more concentrated, is darker.

The skin also throws off carbon dioxid and, to a slight extent, it absorbs oxygen.

Work of the Intestines

The intestines, in their work of elimination, pass off all undigested matter. They also carry off bile pigment, bile salts, mucus, animo acids, and other decomposition of proteins,—also a little unabsorbed fats and bacterial decomposition taking place in the intestines. Coarse articles of food containing fibres which do not digest, such as the bran of grains and the coarser fruits and vegetables (though much of their substances are not food in the strictest sense) are valu-

able to increase the peristaltic movements of the intestines and to act as a carrying body to move the waste excretions along their course.

The combustion, or burning of fuel in any form, (oxidation for the release of latent heat and energy) always leaves some parts which are not used as heat or energy, and it is the work of the intestines to eliminate much of this refuse. When coal is burned, gas, smoke and cinders or clinkers, constitute the waste and if these were not allowed to escape from a stove the fire would soon go out—the smoke and gas would smother it and the clinkers would prevent the circulation of oxygen and soon clog and fill the stove. The same is true in the body—the carbonic acid gas not being allowed to pass off would soon put out the fires of life; it would poison the body and stunt the action of the nerves. If the nitrogenous waste (like ashes and cinders) is not eliminated by the kidneys, one will die in convulsions in one or two days.

The absolute necessity of a free elimination of waste will be readily seen.—If the engine is to do its best work, the engineer sees that it is kept perfectly clean—otherwise it becomes clogged, does

inefficient work and the clogging soon wears out some parts. The same is true in the body,—clogging in any part overworks and wears out other parts dependent upon the work of the one.

Summary

Let us sum up the processes which the food undergoes in its conversion into condition to be absorbed by the body; in its absorption through the walls of the intestines and stomach; and the metabolic processes which it undergoes in being converted into heat and energy and again broken down and eliminated as waste.

The Saliva begins the digestion of starches and sugars in the mouth. This digestion is continued by the saliva in the stomach.

The Stomach, when in normal condition, thoroughly digests the proteins. If any proteins fail of digestion in the stomach the process is completed in the intestines.

The *Intestines,* aside from their work of digestion and absorption, excrete bile pigment, bile salts, animal acids, mucus and

other decomposition of proteins, with bacterial fermentation and putrefactions; also such food materials as are not digested.

The small intestine digests and absorbs the fats and continues the digestion of starches, sugars and fats when this digestion is not completed in the stomach.

The large part of the food is absorbed through the small intestine, though a small part is absorbed through the walls of the stomach and through the large intestine.

Fats are almost entirely absorbed in the small intestine. They are absorbed through the lacteals and are carried into the blood stream.

The Liver. The proteins and the starches (converted into maltose) and sugars pass into the liver. The sugar (including the sugar in vegetables, milk, fruits and that used for sweetening, as well as the carbohydrates which have been changed into maltose, is converted into glycogen in the liver, stored here for a time and again broken down into sugar that it may be in condition to be absorbed into the blood.

The proteins pass through the liver but are not acted upon by this organ until they again return to the liver through the

blood stream, after they have been partly oxidized in the tissues. The liver further oxidizes them putting them into condition to be excreted by the kidneys and intestines.

The liver also breaks up the worn out red corpuscles, putting them into condition to be eliminated in the bile.

It oxidizes and renders harmless poisonous substances absorbed in the food, such as fermented food products and alcohol.

The *Muscles* oxidize the fats and sugars liberating the latent heat and energy.

They partly oxidize proteins which are further broken up in the liver.

The *Nerves* oxidize food materials stored in the nerve cells, providing nervous energy.

The *Lungs* absorb oxygen and throw off carbon dioxid, watery vapor and some organic substances.

The *Kidneys* and The *Skin* purify the blood by excreting water, carbon dioxid and nitrogenous waste.

FACTORS INFLUENCING DIGESTION

As before stated, it is not the food eaten, but that which the body digests and assimilates, or appropriates to its needs, which counts; many factors influence such nourishment. The principal ones are the forceful circulation, the breathing of plenty of oxygen, and the resultant free elimination of waste.

The Appetite

If one has no appetite, by far the safest method is to abstain from food until the system calls for it, or to eat but a very little of the lightest food at regular meal times; be careful not to mince between meals nor to eat candy nor pickles. Be sure that the lack of appetite is not due to mental preoccupation which does not let the brain relax long enough for the physical needs to assert themselves. One should relax the brain in pleasant thoughts during a meal.

If the appetite is lacking, because of physical exhaustion, it is unwise to eat, because the digestive organs are tired, and to load a tired stomach with food, still further weakens it and results in indigestion. The better plan is to drink two glasses of cold water and lie down for an hour; if there is still no desire for food, drink freely of water, but abstain from food until hungry.

This should not lead one into forming the habit of irregular eating, however. The stomach forms habits and the supply of food must be regular, just as the nursing child must be fed regularly, or digestive disturbance is sure to result.

A wise provision of Nature makes the system, in a normal condition, its own regulator, protesting against food when it has not assimilated or eliminated that consumed. One should learn to obey such protests and cut down the quantity when Nature calls "enough."

There are exceptions, however. Some phases of indigestion result in a gnawing sensation in the stomach, which is often mistaken for a desire for food. This is not a normal appetite. Water will usually relieve it.

Often loss of appetite is the result of a clogging of intestines or liver, or to an excess of bile, which, not having been properly discharged into the intestines, has entered the blood stream. An excess of bile and poisons, indicating a torpid liver, often expresses itself in a dull mental force, the toxins deadening the nerve cells. Nature does not call for more food until she has eliminated the excess of waste.

It is commonly stated that the body will call for what the system requires. This may have been true of the aborigines, who ate their food in its natural state, and, to a certain extent, it is true to-day, but condiments and stimulants, to make the food "appetizing," have unduly stimulated the nerves and perverted the natural taste; foods containing their natural amount of spices or extractives no longer tempt one. Those whose nerves are highly keyed, form the habit of seasoning the food too strongly, making it too stimulating. This undue stimulant calls for more food at the time of eating than a normal appetite would demand. The taste being cultivated for the stimulant, the habit of eating too much food is formed.

There is a difference between the cultivated and the normal appetite. A child rarely shows a desire for stimulants or condiments, unless unwisely encouraged by an adult, who does it,—*not because it is good for the child, but because the individual himself has cultivated a taste for it.* It is as easy to form healthful tastes and habits of eating as unhealthful ones, and care should especially be exercised in the formation of healthful habits by the growing child.

The simple foods, in their natural state, are in the right condition to be digested, with the aid of heat to break the cellular coverings of the globules of some of them, but time, energy, muscular activity, nerve force, and money are spent in combining, seasoning, and cooking foods in such a manner as often to render them difficult of digestion.

Deep breathing of fresh air, to throw off the poisonous carbon dioxid and to supply an abundance of oxygen to oxidize the waste, thus putting it in condition to be expelled from the system; brisk exercise to accelerate the circulation, that the blood may carry the oxygen freely and that the tissues may liberate the carbon dioxid and other waste; and a copious drinking of

water, are the best tonics for loss of appetite or for a lack of vitality.

Economy in Food

It is economy, therefore, to keep the digestive organs and the circulation and tissues strong, in order that all foods eaten may yield returns, instead of hampering activity.

The food which furnishes the most tissue-building substance and yields the most heat and energy, with the least refuse, is the economical food. In the selection of food for any individual, the result to be gained from the food must be borne in mind. If one is doing heavy muscular work, more protein to rebuild tissue, as well as more carbohydrates and fats to produce energy, are required than if one's habits of work are sedentary. In mental work, where the brain is continually active, proteins are required to resupply the brain tissue, but the fats and carbohydrates may be lessened. This would seem to contradict the theory that where one's habits are sedentary and the brain alone is active, the proteins are not required. In sedentary occupation, the carbohydrates and fats are stored within the system, clogging it and producing torpid liver, constipation, and obesity,—

unless the brain is sufficiently active to use all of the fuel in brain energy.

In a dietary study of the following tables, the question should be to provide the largest quantity of nutriment at the lowest cost, with due attention to palatability and variety. In the selection of meats, for instances, while beefsteak may cost twice as much as beef stew, it must be borne in mind that beefsteak contains very little waste, and it contains a large proportion of albuminoids, or the tissue building proteins, while, in the beef stew, the bones and the connective tissue predominate; the proteins yielded from the beef stew are a large proportion gelatinoids and extractives, — not the tissue building albuminoids. This would not hold in comparing the cheaper and the more expensive cuts in the same kind of beefsteak; the cheaper cuts often yield quite as much nutriment as the more expensive ones. Round steak is just as nourishing as porter-house and much cheaper.

Much is said about the bacteria present in the atmosphere, the microbes in the food, etc., that one is puzzled to know, not only what to eat, but how to breathe, and, in fact, which way to turn to avoid them; but microbes and bacteria have been

present in the atmosphere and in matter everywhere since time began. They are a part of the natural surroundings, and the body, if kept in strong vitality, has sufficient resistive power to enable one to live unharmed by them. The danger lies in allowing the system to run down and the vital force to ebb, so that the body becomes an easy prey to them.

Habit and Regularity of Eating.

There is no doubt but that the *habit* of eating governs one's convictions of what the system requires. One is inclined to think that a desire for a food is a requirement of Nature; yet it may simply be the continuance of a habit. The vital organs form habits just as one forms a habit of walking, sitting or of carrying the head or the hands, and habit re-asserts itself.

If a mother feeds her babe every three hours the child will usually wake and call for food about this period. If she has formed the habit of nursing the child every two hours, it will call for food in about two hours, even though all symptoms indicate that the child is over fed.

It is important that both child and adult establish regular and hygienic habits because the digestive juices secrete them-

selves at the regular periods established. *A right habit is as easily formed, and as difficult to change, as a wrong one.*

If one forms the habit of eating a certain amount of food, the stomach calls for about the same amount, and when one first begins to change the quantity it protests, whether the change be to eat more or less.

Few people form the habit of drinking sufficient water,—particularly if they have been taught that water at meals is injurious. In this busy life, few remember to stop work and drink water between meals, and if not consumed at the meal time the system suffers. Many people look "dried up."

The habit of drinking two glasses of water upon first arising, and six more during the day is an important one.

Frequency of Meals

There is no doubt but that a large number of people overload the digestive organs. This, as well as the bolting of food, insufficiently masticated, cannot be too strongly denounced. *All food should be chewed to a pulp before swallowed.*

As a relief from overeating, many theorists are advocating two meals a day, but the work of the average man is

planned into morning and afternoon sessions, and the three meals have been arranged accordingly.

Where two meals a day are eaten, the first meal should be at nine or ten o'clock in the morning and the second meal at five or six o'clock in the afternoon; whereas, for the average person who eats two meals a day, the custom is to go without food until the midday meal, and then to eat two meals within six hours, with nothing more for eighteen hours.

The argument in favor of two meals a day has been that the digestive system is inactive during sleep, and, therefore, the system is not ready for a meal upon arising, but the latest experiments (Pawlow) show that digestion continues during sleep, though less actively. It must be borne in mind that the average evening meal is eaten about six o'clock and that there are about four waking hours between this meal and the sleep period; also, that the average individual is awake and moderately active an hour before the morning meal. This gives five waking hours between the evening and the morning meal. About the same time, five hours, elapses between the morning and the midday meal, and between the midday and the

evening meal, so that three meals a day divide the digestion periods about evenly.

More frequent meals, served in lighter quantity, with greater regularity, so that the system is not overloaded at any one meals, is rational for delicate, or under-nourished nerves and tissues. The little child is fed regularly every three hours.

Effect of Exercise and Breathing upon Digestion

Daily exercise and the habit of full breathing are absolutely necessary that the waste of the system may be fully liberated, that the nourishment may be carried freely to every tissue, and that sufficient oxygen may be carried through the blood to oxidize the waste, or, to put it into condition to be thrown off.

The necessity of oxygen as food is evident. The body will subsist about forty days upon the food stored within it, without re-supply, but it can endure only a few seconds without oxygen, because heat, occasioned by the union of oxygen with carbon and hydrogen, is necessary to keep up the physical activity termed "life." *The necessity of habits of full, correct breathing cannot be too fully emphasized.* The quantity of oxygen, daily consumed,

should fully equal the sum of all other food elements.*

Oxygen is necessary to cause combustion of fats, starches and sugars, just as it is necessary to cause combustion of carbon in wood, or coal.

The heat from "burning" wood is produced by the oxygen of the air uniting with hydrogen and carbon, forming carbon-dioxid (carbonic acid gas) and water.

The light in the burning of wood is caused by the rapid combustion of the carbonic acid gas. The same combustion occurs within the body continuously, though more slowly, hence no light is produced.

The carbon in the body is liberated and brought into contact with more oxygen in the blood through exercise and full breathing, just as a fire is fanned to flame by bringing more oxygen into contact with the fire, by means of a draught of air. Keep all air away from a fire and it "goes out," or ceases to unite with the oxygen, and no heat is produced; keep all air from within the body, by cessation of breathing, and it also becomes cold. A room in which

Editor's Note.—Measurements of eighteen thousand women show that sixty-two per cent of women use only about one-half of their lung capacity and less than nine per cent use their full capacity.

the air is impure, containing insufficient oxygen, is heated with difficulty,—the body which is not constantly supplied with pure air generates very little body heat. The effect of oxygen in the creation of heat is practically demonstrated by repeatedly filling the lungs with air while out in the cold. The body will become quickly warmed on the coldest day by this practice.

Deep breathing aids digestion and assimilation, not alone because of the regular exercise given to the pancreas, the spleen, the stomach, and the liver by the correct movement of the diaphragm, but because of the latent heat which the oxygen liberates within the digestive organs and out among the tissues.

While the chemical action of food creates activity within, this activity is materially aided by exercise, and oxygen is imperative, as shown above. Exercise and oxygen are also necessary for chemical action in tearing down waste and in putting raw material into condition to be appropriated to the body needs.

Two glasses of water in the morning and fifteen minutes' brisk exercise of well selected movements, to start a forceful circulation and to surge the water through the vital organs, are a daily necessity if

one is to keep clean and strong within. It is as important to cleanse the body within as without. It is the method employed by all men and women who would retain strong vital forces to a ripe old age. They fully enjoy the mere LIVING.

"Tired" or Disturbed Balance

Since the condition of the body so materially affects the digestion, absorption, and metabolism of food, as well as the elimination of waste, it is not amiss to discuss it here.

The habit of eating when too tired and then at once going to work, so that the blood is called from the stomach, is almost sure to result in indigestion.

The average person is tired because the brain and nerves are more active than the muscles and is rested by muscular exercise, or change of work.

The regular work of the body in keeping up the heart action and the circulation and in renewing and relieving waste, requires a certain quantity of oxygen to liberate energy. This energy the system, in normal condition, with normal breathing, readily furnishes, but when that used in undue muscular work is more than that being liberated at the time, through combustion, the energy required for the con-

stant bodily needs is called upon, and the muscles, nerves and tissues are then in the state termed "tired." They remain so until sufficient oxygen has liberated more potential energy than is needed for the work constantly going on in the body. When a sufficient supply of oxygen has been consumed to equal the demand, the body is in a state of rest.

In mental work the nerves and the brain call for the surplus energy, while in muscular work the tissues require it, hence undue work, either mental or physical, expresses itself in bodily fatigue, until the oxygen equals the demand in all parts of the body.

A torpid condition of body, producing inertness, means that the waste of the system is not relieved. It may be that by reason of insufficient breathing of pure air, sufficient oxygen is not consumed to put the waste in condition to be eliminated. This poisonous carbon dioxid being hoarded, dulls the nerve sensation and the brain action and produces more or less of stupor. It may be because the circulation in some part of the body is clogged (most often the portal circulation through the liver), so that sufficient oxygen is not carried to that part.

Relief from this "inertness" is experienced most quickly by exercise in the fresh air, that the circulation may be quickened and the oxygen more freely carried to each part. Exercise in one's room by the open window, or at least with the air in the room pure, is often preferable to out-door exercise, because the body can be nude, or so loosely clothed that the oxygen may not only enter the lungs but also circulate about the pores of the skin. Fifteen minutes of brisk exercise in one's room is better than a five-mile walk, because if the exercises be intelligently selected, every organ and tissue is used, while walking exercises only about one-fourth of the muscles. If the circulation is clogged, the exercising must be kept up persistently, until the obstruction is removed and particular attention must be given to the supply of fresh air in the room.

After sleeping in a room with impure air, one arises fatigued, because of insufficient oxygen to liberate the energy required for circulation and catabolism, and because the carbonic acid gas cannot be relieved without oxygen to cause combustion. As stated above, if the poisonous carbonic acid gas remains in the system,

it deadens the nerve sensation and produces a semi-stupor.

The relief, then, from the state of body we call "tired," is in the distribution of the circulation, calling the blood from the unduly distended capillaries, and supplying the normal quantity of oxygen. Rightly directed physical exercise renews the circulation to all parts, incites deep breathing, and puts the body in the state of harmony called "rest."

Harmony, either mental or physical, *is rest.*

With a little more intelligence in keeping up the supply and demand of oxygen, in establishing correct breathing habits, and in understanding the law of distribution of circulation, which means the harmony of forces, this tired world could draw a deep, restful breath.

Influence of the Mind

The state of the mind has much to do in regulating the digestive system. Cheerful thoughts put the nerves of the entire organism in a natural state, while disagreeable thoughts put the nerves in a tense, unnatural condition. The nerves to the digestive system are affected by the tensity of the mind, just as the nerves to any other part of the body. As

an illustration of this;—if one thinks ugly, disagreeable thoughts for a continuous period, actual illness results. These thoughts affect the digestion in such a manner that the appetite sometimes entirely wanes. All so-called "new thoughts," "ologies," or "isms," conducive to the formation of the habit of looking upon the bright side of life, or of looking for good and joy in life, put the nerves in a natural state, affecting the digestion and consequently the health. The practice is Christian *Sense*.

The nerves control, to a great degree, the peristaltic movements of the stomach and the action of the absorption cells, as well as the cells which secrete the digestive juices. Thus it is that a food which one likes is not only more palatable, but it will digest more readily, because the digestive juices flow more freely.

It is well, therefore, to begin the meal with something which tastes particularly good, that the flow of these digestive juices may be incited. For this reason, if one cares for fruit, it is an excellent custom to begin the meal with fruit, or with soup, containing protein extractives, which stimulate the flow of digestive juices. The habit of finishing a meal with some tasty

dessert, is based upon the scientific principle that by so doing the gastric juices will flow more freely after the meal, thus aiding in its digestion.

Dainty service in a sick-room, because of the psychic effect of a meal daintily served, is of utmost importance. Because of the effect upon the mind the sight of a meal served upon soiled linen will almost stop the flow of gastric juice and destroy the desire for food, while a meal daintily served upon dainty linen, with garnishings and tasteful table decorations, incites the flow of gastric juices.

The careful wife and mother, who notes the appetites of members of her family failing, should attend carefully to the garnishing of her dishes and to serving them in a neat, attractive manner; also to changing her table decorations, as far as may be consistent, so that the eye as well as the sense of smell and taste may be pleased.

It is strange, but it is true, that just a fresh flower, or a new table decoration, may so put the mind of one who is afflicted with nervous indigestion in a receptive state that the meal more readily digests, while an untidy table, or a lot of food served untidily would retard digestion.

One may be able to control the thoughts under most circumstances but the above is a physiological fact.

Sometimes the sight of quantities of food turns one against it. The custom among hearty eaters, of serving a plate too plentifully, destroys the appetite of one whose digestion is not so hearty.

Our grandmothers' overloaded tables, with sufficient food of various kinds to serve many times the number of participants, might stimulate the appetite of hearty, strong men, while the very sight of so much might turn the appetite of one more delicate, whose system did not crave food.

CLASSIFICATION OF FOODS

In the previous chapters, we have given the classification of the elements in foods which supply the body needs. Below we classify the foods commonly used, according to the predominence of these elements.

Carbonaceous Foods

While all foods contain a combination of element, the foods described below contain a greater proportion of carbohydrates and fats, and are classed as *carbonaceous.*

Roots and Tubers

Of the carbohydrates, next in importance to the sugars and to the starches in their purest form (corn starch, tapioca,, sago, and arrowroot), come the roots and tubers, such as potatoes, sweet potatoes, beets, parsnips, turnips and onions.

The following table shows the proportion of various foodstuffs in these vegetables:

TABLE I—ROOTS AND TUBERS

Food Materials	Water Per Cent	Protein Per Cent	Fat Per Cent	Carbohydrates Per Cent	Ash Per Cent	Food Value per pound Calories
Sweet Potatoes	69.4	1.5	0.3	26.2	2.6	440
White Potatoes	75.0	2.1	0.2	22.0	0.7	295
Parsnips	64.4	1.3	0.4	10.8	1.1	230
Onions	86.0	1.9	0.1	11.3	0.7	225
Beets	87.0	1.4	0.1	7.3	0.7	160
Carrots	88.2	1.1	0.4	8.2	6.0	210
Turnips	92.7	0.9	0.1	0.1	0.6	120

Potatoes. It will be noted from the above table that sweet potatoes have a larger percentage of carbohydrates, hence they produce more heat and energy, than any other vegetable; next to the sweet potato, the Irish potato.

In the above table, the skins of the vegetables are included, and while the white potato contains two per cent protein, this is almost all located in a very thin layer immediately beneath the skin, so that when the potato is peeled in the ordinary way, the protein is removed. This holds true in many vegetables. They lose their distinctive flavor, as well as their value as tissue building foods, when the skins are removed. In baking a potato, the outer

skin is readily separated from a less perceptible covering containing the protein, and this second skin should be eaten to get the full value and flavor.

In the white potato, of the twenty-two per cent carbohydrates three and two-tenths per cent is sugar and eighteen and eight-tenths per cent is starch. In the sweet potato, ten and two-tenths per cent is sugar and sixteen per cent is starch. Since sugar digests more quickly than starch, the sweet potato digests more quickly than the white. Because of the large per cent or carbohydrates in each, it is a mistake to serve these two vegetables at the same meal. For the same reason, bread and potatoes should not be eaten, to any extent, at the same meal, unless by one who is doing heavy manual labor, requiring much energy.

Onions. Only about four per cent of the onion represents nourishment; the eleven per cent of carbohydrates is made up of two and eight-tenths per cent sugar and the rest extractives. Of the extractives the volatile oil, which causes the eyes to water when peeling, is the most important. The onion is not, therefore, so important for its actual nourishing qualities as for

its relish and flavor, and for this it is to be commended. It is a diuretic, encouraging a free action of the kidneys. Because of its diuretic value it is commonly called a healthy food. An onion and lettuce sandwich stimulates the action of the kidneys and is a nerve sedative.

The volatile oil makes the onion difficult for some to digest and, in that case, should be omitted from the diet.

Beets. There is no starch in beets, the seven and three-tenths per cent carbohydrates being sugar; they possess, therefore, more nutritive value than onions, and they are easily digested. It will be noted that it takes many beets to make a pound of sugar.

There are no more delicious nor nutritive greens than the stem and leaf of the beet. These greens contain much iron and are valuable aids in building up the iron in the blood, thus correcting anaemia.

Carrots. Carrots are valuable as food chiefly on account of their sugar. They are somewhat more difficult of digestion than beets and they contain more waste. They make a good side dish, boiled and served with butter or cream.

Turnips. Turnips have little value as a food. Their nutriment consists in the sugar they contain. For those who enjoy the flavor they are a relish, serving as an appetizer, and, like the onion, are to be recommended as a side dish for this purpose.

Parsnips. Like carrots, parsnips are chiefly valuable for their sugar and for the extractives which act as appetizers.

Since turnips, carrots, onions, and parsnips owe a part of their value in nutrition to the extractives which whet the appetite for other foods, it follows that, if one does not enjoy the flavor or the odor, these vegetables lose in value to that individual as a food. If one does enjoy the flavor, it adds to their food value.

Green Vegetables

The question may be asked with reason: "Why do we eat green vegetables?" They contain only about four per cent nutrition, as will be seen by the chemical analysis in the following table, and are mostly made up of water and pulp. It will be noted from the table that they are distinctly lacking in protein (nitrogenous matter) and in carbohydrates; hence, they have little food

value. Some of them have strong acids, thus increasing the alkalinity of the blood.

Their merit lies in the fact that they have distinct flavors and thus whet the appetite. Another reason why green vegetables are thoroughly enjoyed is because they come fresh in the spring, when the appetite is a little surfeited with the winter foods and one looks for green things.

TABLE II—GREEN VEGETABLES

Food Materials	Water per cent	Nitrogenous Matter per cent	Fat per cent	Carbohydrates per cent	Mineral Matter per cent	Cellulose per cent	Fuel Value per pound Calories
Cabbage	89.6	1.80	0.4	5.8	1.3	1.1	165
Spinach	90.6	2.50	0.5	3.8	1.7	0.9	120
Vegetable Marrow	94.8	0.06	0.2	2.6	0.5	1.3	120
Tomatoes	91.9	1.30	0.2	5.0	0.7	1.1	105
Lettuce	94.1	1.40	0.4	2.6	1.0	0.5	105
Celery	93.4	1.40	0.1	3.8	0.9	0.9	85
Rhubarb	94.6	0.70	0.7	2.3	0.6	1.1	105
Water Cress	93.1	0.70	0.5	8.7	1.3	0.1	110
Cucumbers	95.9	0.80	0.1	2.1	0.4	0.5	10
Asparagus	91.7	2.20	0.2	2.9	0.9	2.1	110
Brussels Sprouts	93.7	1.50	0.1	3.4	1.3	0.4	95
Beans (string)	8.92	2.3	0.3	7.4	0.8	7.0	195
Beans (dried)	12.6	22.5	1.8	59.6	3.5	0.0	1605
Peas (green, shelled)	74.6	7.0	0.5	16.9	1.0	0.0	465

All fresh vegetables should be masticated to almost a fluid consistency; otherwise, they are difficult of digestion, containing, as they do, so much pulp.

They are diuretic, helping the kidneys and the skin to rid the system of waste, and they are more laxative to the intes-

tines than the root vegetables, partly because of the salts which they contain and partly because of the undigested vegetable fibre, which helps to move along the waste in the intestines. This vegetable fibre, being coarse, assists in cleansing the mucous lining of stomach and intestines, and, if for no other reason than for this cleansing of kidneys and intestines in the spring, when the system is most sluggish, the use of green vegetables is to be commended.

In larger cities, fresh vegetables are in the markets the year around, but if they are raised in greenhouses, or in any way forced, they lack the matured flavor and they also lack the iron which the rays of the sun give. If raised in the south and shipped for a distance, they are not fresh and they do not have as good an effect upon the system as when fresh and fully matured by the sun.

All greens, as spinach, chard, dandelions and beet tops, as previously stated, contain iron and build red blood corpuscles.

It is well, then, to eat freely of fresh vegetables in their season, even though they do not appreciably build tissue or furnish energy. By their effect upon the

blood, the kidneys, skin, and intestines, they make sluggish vital organs more efficient.

Tomatoes and rhubarb are often, and with reason, classed under fruits.

Fruits Technically speaking, fruits include all plant products which bear or contain a seed. They are valuable for their acids and organic salts—citrates, malates, or tartrates of potassium, sodium, magnesium, and calcium. In the juices of citrous fruits, are citrates of above minerals.

The fruit juices are readily absorbed and carried at once to the liver, where the sodium, magnesium, and potassium are released and the acids oxidized and changed to carbonates. They increase the alkalinity of the blood. These alkalis are soon eliminated through the kidneys, which accounts for the diuretic effect of fruits.

The seeds in the small fruits are not digested, but they serve the purpose of increasing intestinal peristalsis and of assisting the movement of the contents of the intestines. The skin and the fibre of fruits also assist the intestines in this way, just as the fibre in vegetables does.

Fruits may be classified into acid and sweet fruits. Under *acid fruits* are the citrous group—lemons, limes, grape fruit, oranges, cranberries, gooseberries, whortleberries, pineapples, currants, and rhubarb—if rhubarb is to be classed as a fruit.

There has been a commonly accepted theory that where a blood test shows evidence of too much uric acid, acid fruits are to be avoided, but the reverse is true. It has been fully demonstrated that the use of acid fruits increases the alkalinity, —or neutralizes the acids in the blood.

In case of an excess of hydrochloric acid in the stomach, lemon, or citrous fruits are valuable about half an hour before a meal as they decrease the secretion of the hydrochloric acid into the stomach. Where hydrochloric acid is limited, acids are given after a meal to supplement the deficient amount.

The sweetening of acid fruits does not detract from the value of the acids or of organic salts.

All acid fruits stimulate the action of the kidneys and the skin,—particularly lemons, limes, grape fruit, and oranges, and wherever the kidneys and skin are not sufficiently active, these fruits should be eaten freely.

It is difficult to make a decided distinction between sweet and acid fruits. The best guide is in the amount of sugar required to make them palatable. Some species of cherry are distinctly sour, while others are sweet. The same is true of apples, peaches, plums, etc.

Under *sweet* or *bland* fruits are pears, raspberries, grapes, bananas, blackberries, blueberries, melons, apricots, and some peaches, apples, and plums.

The large majority of fruits do not contain sufficient sugar to make them valuable for nourishment. Their chief value is in their appetizing flavor, and in the acids, and salts. Dates, figs, prunes, and dried grapes (raisins) are exceptions. As will be noted by the following table, these fruits contain a large amount of carbohydrates in the form of sugar. The larger amount of protein in these sweet fruits is largely in the seeds and, as the seeds are not digested, they have no real food value to the individual.

Figs and prunes are laxative,—probably the laxative effect of figs is due to the seeds, and of prunes to the salts and acids. However, prunes are free from tannic acid.

TABLE III—FRUITS

Food Materials	Water Per Cent	Protein Per Cent	Ether Extract Per Cent	Carbo-hy-drates Per Cent	Ash Per Cent	Cellu-lose Per Cent	Acids Per Cent
Acid:							
Apples	82.50	0.40	0.5	12.5	0.4	2.7	1.0
Apricots	85.00	1.10	0.6	12.4	0.5	3.1	1.0
Peaches	88.80	0.50	0.2	5.8	0.6	3.4	0.7
Plums	78.40	1.00	0.2	14.8	0.5	4.3	1.0
Cherries	84.00	0.80	0.8	10.0	0.6	3.8	1.0
Gooseberries	86.00	0.40	0.8	8.9	0.5	2.7	1.5
Currants	85.20	0.40	0.8	7.9	0.5	4.6	1.4
Strawberries	89.10	1.00	0.5	6.3	0.7	2.2	1.0
Whortleberries	76.30	0.70	3.0	5.8	0.4	12.2	1.6
Cranberries	86.50	0.50	0.7	3.9	0.2	6.2	2.2
Oranges	86.70	0.90	0.6	8.7	0.6	1.5	1.8
Lemons	89.3	1.00	0.9	8.3	0.5	1.5	1.8
Pineapples	89.3	0.04	0.3	9.7	0.3	1.5	7.0
Pears	83.90	0.40	0.6	11.5	0.4	3.1	0.1
Blackberries	88.90	0.90	2.1	2.3	0.6	5.2	1.6
Raspberries	84.40	1.00	2.1	5.2	0.6	7.4	1.4
Mulberries	84.70	0.30	0.7	11.4	0.6	0.9	1.8
Grapes	79.00	1.00	1.0	15.5	0.5	2.5	0.5
Watermelons	92.90	0.30	0.1	6.5	0.2	1.0	0.5
Bananas	74.00	1.50	0.7	22.9	0.9	0.2	0.5
Sweet:							
Dates, dried	2.08	4.40	2.1	65.1	1.5	5.5	7.0
Figs, dried	2.00	5.50	0.9	62.8	2.3	7.3	1.2
Prunes, dried	2.64	2.40	0.8	66.2	1.5	7.3	2.7
Raisins	10.60	2.50	4.7	74.7	3.1	1.7	2.7

Care should be exercised in selecting ripe fruits and those which have not started to decay. The difficulty with so many fruits, which must be shipped from a distance, is, that, in order to reach their destination in fair condition, outwardly,

they are picked before ripe and there is too much tannic acid in them. When fruits are allowed to ripen on the trees, the tannic acid is changed to sugar and fruit juices. One test of a ripened apple is to cut it with a steel knife—if the blade turns black, or if the cut surface of the apple turns brown in a few minutes, it should not be eaten, for it indicates an excess of tannin. It is this tannin which gives the small boy, with his green apples, excrutiating pains. It will be recalled that the tannin from the bark of trees, so toughens the elastic skin of animals that we can wear this skin for shoes. The effect upon the live skin of the stomach and intestines, from the tannin in food, is not pronounced in toughening the skin, because of the activity and resistance of live matter.

Bananas are commonly picked green, because they decay so quickly that if they were picked ripe they would spoil before reaching the northern markets. The above table shows that bananas contain nearly twenty-three per cent of carbohydrates, which, in an immature state, are largely starches. The natural ripening process changes the starch to sugar, thus making them more easily digested. The starch globules, when not matured on the tree,

are not easly broken and are thus difficult of digestion. Baking breaks the globules; a baked banana is thus more readily digested.

Nitrogenous Foods

As previously stated, in a mixed diet meat and eggs are the chief sources of nitrogenous foods. Next to these come the legumes.

Meat

Meat is almost all digested in the stomach by the gastric juice, which changes it into peptone. It is needless to say that it should be thoroughly masticated that there may be no delay in the prompt action of the gastric juice upon it. If any part passes into the intestine undigested, the process is continued by the trypsin of the pancreatic juice. The peptone is absorbed as peptone and after it passes through the inner coating of the intestines, it is changed back to protein and carried by the blood and lymph to all tissues of the body, where it is used for growth and repairs. As stated, any excess

of protein above that needed for growth and repair, is oxidized in the blood, yielding energy and heat, and the waste is eliminated through the kidneys and the bile. The red blood corpuscles, which are nitrogenous, are broken down in the liver and discharged through the bile.

TABLE IV—ANIMAL FOODS

Food Materials	Water Per Cent	Protein Per Cent	Fat Per Cent	Carbo-hy-drates Per Cent	Ash Per Cent	Fuel Value Per Pound Calories
Beef, Fresh	54.0	17.0	19.0	......	0.7	1,105
Flank	54.0	17.0	19.0	......	0.7	1,105
Porterhouse	52.4	19.1	17.9	......	0.8	1,100
Sirloin steak	54.0	16.5	16.1	......	0.9	975
Round	60.7	19.0	12.8	......	1.0	890
Rump	45.0	13.8	20.2	......	0.7	1,090
Corned beef	49.2	14.3	23.8	......	4.6	1,245
Veal:						
Leg cutlets	68.3	20.1	7.5	......	1.0	695
Fore quarter	54.2	15.1	6.0	......	0.7	535
Mutton:						
Leg, hind	51.2	15.1	14.7	......	0.8	890
Loin Chops	42.0	13.5	28.3	......	0.7	1.415
Lamb	49.2	15.6	16.3	......	0.85	967
Ham:						
Loin chops	41.8	13.4	24.2	......	0.8	1,245
Ham, smoked	34.8	14.2	33.4	......	4.2	1,635
Sausage:						
Frankfurter	57.2	19.6	18.6	1.1	3.4	1,155
Fowls	47.1	13.7	12.3	......	0.7	765
Poultry:						
Goose	38.5	13.4	29.8	......	0.7	1,475
Turkey	42.4	16.1	18.4	......	0.8	1,060
Animal Viscera:						
Liver (sheep)	61.2	23.1	9.0	5.0	......	......
Sweetbreads	70.9	16.8	12.1	......	1.6	......

TABLE IV—ANIMAL FOODS (Continued)

Food Materials	Water Per Cent	Protein Per Cent	Fat Per Cent	Carbo-hy-drates Per Cent	Ash Per Cent	Fuel Value Per Pound Calories
Tongue, smoked and salted	35.7	24.3	31.6	......	8.5	......
Brain:	80.6	8.8	9.3	......	1.1	......
Fresh Fish						
Bass large-mouthed Black, dressed	41.9	10.3	0.5	......	0.6	215
Cod steaks	72.4	16.9	0.5	......	1.0	335
Shad roe	71.2	23.4	3.8	......	1.6	595
Whitefish, dressed	46.1	10.2	1.3	......	0.7	245
Preserved Fish:						
Halibut, salted, smoked and dried	46.0	19.1	14.0	......	1.9	945
Sardines, canned	53.6	24.0	12.1	......	5.3	955
Salmon, canned	59.3	19.3	15.3	......	1.2	1,005
Mollusks:						
Oysters, solid	88.3	6.1	1.4	3.3	0.9	235
Round clams removed from shell	80.8	10.6	1.1	5.1	2.3	340
Mussels	42.7	4.4	0.5	2.1	1.0	140
Crustaceans:						
Lobster, in shell	31.1	5.5	0.7	......	0.6	130
Crab, in shell	34.1	7.3	0.9	0.5	1.4	185
Shrimp, canned	70.8	25.4	1.0	0.2	2.6	520
Terrapin, turtle, etc.	17.4	4.2	0.7	......	0.2	105

In the composition of meat, of course there is more or less fat, varying from two to forty per cent, according to the animal and to the condition at the time of killing. It is possible to combine the fat and the lean of meat so as to meet the requirements of the body without waste. About ninety-seven per cent of the meat consumed is assimilated by the system, while a large

part of the vegetable matter consumed is excreted as refuse. The compounds contained in the animal foods are much like those of the body, therefore, they require comparatively little digestion to prepare them for assimilation—this work having been done by the animal—while the vegetable compounds require much change by the digestive system before they can be used in the body.

Fish and sea foods are, many of them, rich in protein, as seen by the above table. Note that sardines contain the largest proportion of protein and next to these, shad roe.

There is a prevalent idea that fish is brain food. In so far as fish is easily digested, it builds brain tissue, but no more so than beef, or any food containing a goodly proportion of protein, easily digested, absorbed, and assimilated.

Lobsters are difficult of digestion and they contain little nutrition, so they are not valuable as a food.

Oysters, raw, are easier to digest than when cooked. Oysters should not be eaten during the spawning season from May to September.

Roasted flesh seems to be more completely digested than boiled meat, but raw

meat is more easily digested than cooked. Roasted chicken and veal are tender, easily masticated, and easily and rapidly digested in the stomach. This is one reason why the white meats are considered a good diet for the sick-room, especially in the case of stomach difficulty. Fat meats remain in the stomach a much longer time than lean meats; thus, gastric digestion of pork, which is largely fat, is especially difficult. Fried pork, in which the fat is heated to a very high degree, is very difficult of digestion. (See page 197).

The chief objection to pork, however, is that hogs are scavengers and live upon all sorts of refuse. Another objection is that in preparing hogs for the market, the effort of the farmer is to force the feeding and get them as fat as possible. This excess of fat may result in degeneration of the meat tissue. The latter objection does not hold, however, for hogs carefully fatted for home consumption, or for hogs which run in the forests and live upon nuts, as do the beech fed hogs of the south.

The best meats are from young animals which have been kept fat and have not been subjected to any work to toughen the muscles.

Preserved and canned meats should be eaten with the utmost caution, not only because of the inferior meat used in the preparation of these foods, but also from the fact that they may become putrid after being canned.

The proportion of *albuminoids, gelatinoids* and *extractives* in meat vary with different meats and with different cuts of the same meat.

The *albuminoids* of meat include the meat tissue, or the muscle cells. These constitute by far the greater part of the meat.

The *gelatinoids* are the connective tissue forming the sheath of the muscle and of bundles of muscles, the skin, tendons, and the casein of bone. Gelatines are made from these and, if pure and prepared in a cleanly manner, they are wholesome. Gelatin is distinguishable in rich meat soups, which jelly upon cooling.

While the gelatinoids are not muscle, they keep the muscles from being consumed when starches, sugars, and fats are lacking, and, in this sense, may be considered more in the nature of carbohydrates.

The *extractives* consist of a substance within the lean meat, known as creatin.

This creatin is not a food; it is an appetizer, and gives to cooked meats, broths, etc., their pleasing flavor. In case of anaemia where it is necessary to build up red blood corpuscles, it is desirable to have the patient take the blood of beef, the thought of which is usually repellant, but it may be made very palatable if it is heated sufficiently to bring out the extractives, or flavor, and then seasoned.

Unless the beef extracts on the market contain the blood tissue in addition to the extractives, they are not particularly nourishing and are only valuable in soups, etc., as appetizers.

One reason why meat soups constitute the first course at dinner is because the extractives stimulate the appetite and start the flow of gastric juices. Bouillons contain no nourishment, because the proteins have been coagulated by the vigorous boiling, but they may be used as a basis for vegetables, rice, or barley to give them flavor.

The best method is to make one's own soup from the connective tissues (gelatinoids) and meat tissue.

Eggs

Eggs consist chiefly of two nutrients,—protein, and fat (ten per cent), combined with water, phosphorous, and ash.

Eggs are a wholesome source of protein and are, therefore, classed as nitrogenous foods.

The fat and the iron are in the yolk, which is about one-third fat. The yolk also contains phosphorous and some ash. The white is practically free from fat but contains sulphur, phosphorous and a very little ash. The white and the yolk contain almost equal quantities of protein.

The white of the egg is said to be pure albumen; the chief ash constituent is common salt. The total phosphorous in the white of the egg is equivalent to about two per cent phosphoric acid and the total phosphorous in the yolk is equivalent to one per cent.

The dark stain made by eggs on silver is due to the sulphur contained in them. The iron in the egg is valuable to assist in building red corpuscles.

The large part of the egg, as other proteins, is changed, mostly in the stomach, into peptone, absorbed as peptone and then changed back again into protein after absorption. That not digested in the stomach is changed in the intestine, as is the case with other proteins.

Eggs are, no doubt, excellent articles of food for nutrition and for tissue building.

They contain more water than cheese, but are more concentrated than milk or oysters. They have practically the same relative value in the diet as meat, and make a very good substitute for meat. Egg yolk in abundance is often prescribed where it is necessary to supply a very nutritious and easily assimilated diet.

One of the best methods of preparing eggs, which is especially valuable for those having delicate stomachs or for those who need to build up red blood corpuscles with the iron in the yolk, is in egg lemonade or orangeade. Thoroughly beat the egg, add the juice of half a lemon or orange, sugar to taste, and fill the glass with water.

The citric acid in these fruits partly digests the egg, changing it into egg albumin,—the egg becomes limpid, no longer stringy. From this condition the gastric juice quickly changes it to peptone.

Grape juice, cream, and cocoa may be used in place of lemon or orange, in order to give variety where it is necessary to take many of them, but the grape juice acid does not partially digest the egg as the juice of the lemon does.

Eggnog is another means of taking raw eggs.

One method which any housewife can use to test the freshness of eggs is to drop them into a strong, salt brine made of two ounces of salt to a pint of water. A fresh egg will at once sink to the bottom. After the third day the surface of the shell will be even with the surface of the water and with increasing age they will rise still higher.

There is a prevalent opinion that if an egg is boiled hard it is difficult of digestion, but this depends entirely upon the mastication. If it is masticated so that it is a pulp before swallowed, a hard boiled egg is digested as readily as a soft boiled one. If it is not thoroughly masticated, then an egg should not be boiled longer than three to four minutes, or should be put into boiling water and allowed to remain in the water for six minutes without actively boiling. The latter method cooks the egg through more evenly. Another method of cooking the yolk evenly with the whites is to put the egg in cold water, let it come to a boil, and then again immerse in cold water. Or the egg may be put in cold water, let come almost to a boil, removed from the stove, and let stand ten to twelve minutes in the hot water. Any one of the

last three methods cooks the white and the yolk evenly.

Carbo-Nitrogenous Foods

Under this class come cereals, legumes, nuts, milk, and milk products. In these foods the nitrogenous and carbonaceous elements are more evenly proportioned than in either the carbonaceous or nitrogenous groups. The different food elements in this group are so evenly divided that one could live for a considerable length of time upon any one food. Some animals build flesh from nuts alone, while the herbiverous animals live upon cereals and plants.

Cereals

Under cereals, used by man for food, come wheat, oats, rye, barley, rice, and corn. As will be noted by the table below, cereals contain a large proportion of starch and are therefore to be used largely for heat and energy. Rice contains the largest proportion and next to rice, wheat flour.

TABLE V—CEREALS

Food Materials	Water Per Cent	Protein Per Cent	Fat Per Cent	Carbohydrates		Ash Per Cent
				Starch etc. Per Cent	Crude Fiber Per Cent	
Wheat	10.4	12.1	2.1	71.6	1.8	1.9
Rice	12.4	7.4	0.4	79.2	0.2	0.4
Oats	11.0	11.8	5.0	59.7	9.5	3.0
Rye	11.6	10.6	1.7	72.0	1.7	1.9
Breads and Crackers:						
Wheat bread	32.5	8.8	1.9	55.8	.....	1.0
Graham bread	34.2	9.5	1.4	53.3	.....	1.6
Rye bread	30.0	3.4	0.5	59.7	.....	1.4
Soda crackers	8.0	10.3	9.4	70.5	.....	1.8
Graham crackers	5.0	9.8	13.5	69.7		2.0
Oatmeal crackers	4.9	10.4	13.7	69.6	.....	1.4
Oyster crackers	3.8	11.3	4.8	77.5	.....	2.6
Macaroni	13.1..	9.0	0.3	76.8	.....	0.8
Flours and Meals:						
Flour, wheat	12.5	11.0	1.0	74.9	.....	0.5
Corn Meal	15.0	9.2	3.8	70.6	.....	1.4
Oatmeal	7.6..	15.1	7.1	68.2	.....	2.0

There is no part of the world, except the Arctic regions, where cereals are not extensively cultivated. From the oats and rye of the north, to the rice of the hot countries, grains of some kind are staple foods.

"An idea of the importance of cereal foods in the diet may be gathered from the following data, based upon the results obtained in dietary studies with a large number of American families:—Vegetable foods, including flour, bread, and other cereal products, furnished fifty-five per cent of the total food, thirty-nine per cent

of the protein, eight per cent of the fat, and ninety-five per cent of the carbohydrates of the diet. The amounts which cereal foods alone supplied were twenty-two per cent of the total food, thirty-one per cent of the protein, seven per cent of the fat and fifty-five per cent of the total carbohydrates—that is, about three-quarters of the vegetable protein, one-half of the carbohydrates, and seven-eighths of the vegetable fat were supplied by the cereals. Oat, rice, and wheat breakfast foods together furnished about two per cent of the total food in protein, one per cent of the total fat, and four per cent of the carbohydrates of the ordinary mixed diet, as shown by the statistics cited. These percentage values are not high in themselves, but it must be remembered that they represent large quantities when we consider the food consumed by a family in a year."*

If one's work calls for extreme muscular exertion, the cereals may be eaten freely, but if one's habits are sedentary, and the cereals are used in excess, there is danger of clogging the system with too much glycogen, or converted starch. Indeed, for one whose occupation is indoors and requires little muscular activity,

* Charles D. Woods Dr. Sc. in "Cereal Breakfast Foods."

a very little cereal food will suffice; the carbohydrates will be supplied, in sufficient quantity, in vegetables. Mineral matter is supplied in sufficient quantity in almost all classes of foods.

The power of the system to throw off food, over and above the needs of the body, is a wise provision of Nature, because where foods are not supplied in the proper proportions, a more liberal diet enables the system to select such foods as it needs from the abundance.

Cereals and legumes supply nutrients cheaper than any class of foods; therefore a vegetarian diet involves less expense than the mixed diet. Meat, eggs and milk, which usually supply the proteins, are the most expensive foods, and where these are eliminated, a large proportion of proteins should be supplied by the legumes.

Wheat. Perhaps no food is as commonly used as wheat, in its various forms, It is composed of:

First—The nitrogenous or protein compound, chiefly represented in the cerealin and the gluten of the bran.

Second—The carbon extracts,—the largest contributor to the flour.

Third—The fats, occurring chiefly in the germ of the grain.

Fourth—The phosphorous compounds, iron and lime, found in the bran.

The kernel of wheat consists of the bran or covering, which surrounds the white, pulpy mass of starch within. In the lower end of the kernel is the germ.

Flour. In the old time process of making flour the wheat was crushed between stones and then sifted, first, through a sieve, which separated the outer shell of the bran; then through bolting cloth, which separated the white pulp from the inner bran coating. It was not ground as fine as in the present process, thus the gluten, phosphorous, and iron (valuable foods) were, in the old process, nearly all left out of the white flour. The second bran coating, left by the second sifting, was not so coarse as the outer shell but coarser than the inner. Care was not formerly observed in having the grain clean before grinding, the bran containing chaff and dirt, so that it was not used as food but was considered valuable for stock and was called "middlings."

The modern process of crushing the wheat between steel rollers, crushes it so fine that the white flour of to-day contains

more of the protein from the inner coat of the bran than the white flour of the old process; hence, it is more nutritious.

Bran. Objection is sometimes made to bran because the cellulose shell is not digested, but bran contains much protein and mineral matter and, even though it is crude fiber, as stated above, this fiber has a value as a cleanser for the lining of stomach and intestines, and for increasing peristalsis, thus encouraging the flow of digestive juices and the elimination of waste. In bread or breakfast foods, it is desirable to retain it for its laxative effect.

The bran has three coats,—the tough, glossy outside, within this a coat containing most of the coloring matter, and a third coat, containing a special kind of protein, known as cerealin. The two outer layers contain phosphorous compounds, lime, and iron. All three coats contain gluten.

Of course there is more waste in bread made with bran and in consequence, there is a smaller *proportion* of the nutrition in graham bread. It is held by some, however, that more of the nutrition is digested than in white bread.

Gluten flour is made of the gluten of wheat. It is a valuable, easily digested

food, containing a large proportion of protein.

Whole wheat flour does not contain the whole of the wheat, as the name implies; it, however, does contain all the proteins of the endosperm and the gluten and oil of the germ, together with all of the starch. As a flour, therefore, it is more valuable than the white flour, containing more nitrogenous elements.

Graham flour is the entire wheat kernel; with the exception of the outermost scale of the bran. It contains the starch, gluten, phosphorous compounds, iron and lime. It is the most desirable of the flours because, containing the bran, it assists in digestion and elimination, and the phosphorous, iron and lime are valuable for body building.

Nutri meal is much the same as Graham flour, the chief difference being that the bran is ground finer. The wheat is ground between hot rollers, the heat bringing out the nutty flavor of the bran. It contains all of the nutrition of the wheat.

Bread. As must be implied from the above, the "whole wheat," nutri meal, or graham flours are necessary if bread is to be a complete food.

There is perhaps no form of prepared food which has been longer in vogue. It has been known since history began. It probably maintains and supports life and strength better than any single food. The ease with which it is digested depends very largely upon its porous condition. When full of pores, it is more readily mixed with the digestive juices.

The pores in bread are produced by the effort of the gas, released by the yeast, to escape. When mixed with water, the flour forms a tenacious body which, when warm, expands under the pressure of the gas from the yeast, until the dough is full of gas-filled holes. The walls of the gluten do not allow the gas to escape, and thus the dough is made light and porous. The more gluten the flour holds, the more water it will take up in the dough, and the greater will be the yield of bread; hence, the more gluten, the more valuable the flour. If the bread is not porous, the fermentation is not complete, and the bread is heavy.

Yeast is a plant fungus. In its feeding, the plant consumes sugar, changing it into alcohol and carbonic acid gas. If the bread contains no sugar the yeast plant will change the starch in the flour into sugar for its feeding. Many housewives, realiz-

ing that the bread begins to "rise" quicker if it contains sugar, put a little into the sponge. Unless a large quantity of sugar is put in, the yeast will consume it and the bread will not have an unduly sweet taste.

As the yeast causes fermentation, alcohol forms in the dough. This is driven off in the baking. If the bread is not thoroughly done, the alcohol continues to ferment and the bread turns sour. Bread is not thoroughly baked until fermentation ceases. It is claimed that fermentation does not entirely cease with once baking; this is the basis of the theory, held by some, that bread should be twice baked. The average housekeeper bakes an ordinary loaf one hour.

Time must be given for the products of fermentation to evaporate, in the cooling of the bread, before it is eaten and it is not ready to eat for eight to ten hours after baking. Hot or insufficiently cooked bread is difficult of digestion, because it becomes more or less soggy upon entering the mouth and the stomach, and the saliva and gastric juices cannot so readily mix with it.

The best flour for bread is that made from the spring wheat, grown in cooler climates, because it is richer in gluten than

the winter wheat. The winter wheat flour is used more for cakes and pastries.

Bread made from milk, is, of course, richer and more nutritious than that made from water and bread made from potato water contains more starch; both of these retain their moisture longer than bread made with water.

Mould, which sometimes forms upon bread, is, like the yeast, a minute plant. It is floating about everywhere in the air, ready to settle down wherever it finds a suitable home. Moisture and heat favor its growth, hence bread should be thoroughly cooled before it is put into a jar or bread box and the bread box should be kept in a cool place.

Rye bread contains a little more starch and less protein than wheat bread. It contains more water and holds its moisture longer.

Biscuits. The objection to eating hot bread, does not hold for baking powder or soda biscuits, if well cooked, because these cool more rapidly and they do not contain the yeast plant; hence, they do not ferment as does the bread.

Baking powder is made from bicarbonate of soda (baking soda) and cream of tartar. When these are brought in contact

with moisture, carbon dioxid is formed, and, in the effort to escape, it causes the dough to expand and become light. The reason that the cook attempts to bake her biscuits, or anything made with baking powder as quickly as possible, after the baking powder comes in contact with the moisture, is that the dough may have the full effect of the expansion of the gas. If the room in which she mixes her dough is cool, or if her biscuit dough is left in a cool place, this is not important, as heat and moisture are both required for full combustion.

Macaroni and spaghetti are made from a special wheat flour rich in gluten known as Durum. They contain about seventy-seven per cent starch, little fat and little protein. They may take the place of bread, rice or potato at a meal.

Rice is a staple cereal in all tropical and temperate climates. It requires special machinery to remove the husk and the dark, outer skin of the kernel. It is seldom eaten within three months after harvesting and it is considered even better after two or three years. It requires thorough cooking.

Unhusked rice is called paddy.

Wild rice is used by the North American Indians. The seeds are longer, thinner and darker, than the tame rice. It is coming into favor as a side dish, but it is served more particularly at hotels in soup and with game.

As previously stated, rice contains a larger proportion of starch than any other cereal and the smallest proportion of protein. Next to rice, in starches, comes wheat flour; yet whole wheat or graham flour contain half as much again of protein.

Because of the quantity of starch in flour, potatoes and rice, it is obvious that one should not eat freely of more than one of these at the same meal, else the digestive organs will be overworked in converting the starch into sugar and the liver overworked in converting the sugar into glycogen and back again into sugar; and the liver will be overloaded in storing it up. By far the best plan is to eat but one cereal at a meal.

Rice contains no gluten, hence it cannot be raised in bread.

Corn (maize) is a native of America and has been one of the most extensively used cereals. Corn bread and corn meal mush were important foods with the early

settlers, partly because they are nutritious and partly because the corn meal was easily prepared at the mill and was cheap. The germ of the corn is larger in proportion than the germs of other grains, and it contains much fat; therefore it is heating. For this reason, it is strange that corn bread is so largely used by inhabitants of the southern states. It is a more appropriate food for winter in cold climates.

Because of the fat in the germ, cornmeal readily turns rancid, and, on this account, the germ is separated and omitted from many cornmeal preparations.

Hulled corn, sometimes called lye hominy, is one of the old-fashioned ways of using corn. In its preparation, the skin is loosened by steeping the corn in a weak solution of lye, which gives it a peculiar flavor, pleasing to many.

Cornmeal mush is a valuable breakfast food.

Pop corn. The bursting of the shell in popping corn is due to the expansion of the moisture in the starch, occasioned by the heat.

Green sweet corn does not contain the same proportion of starch as cornmeal, it being, in its tender state, mostly water. It is laxative, because it is eaten with the

coarse hull, which causes more rapid peristalsis of the intestines.

Breakfast Foods

The claims made for various advertised breakfast foods would be amusing if they were not intended to mislead. Nearly all of them have sufficient merit to sell them, if the advertiser confines himself strictly to the truth, but the ever pertinent desire to excel, which is one great incentive to progress, leads to exaggeration. For example: Claim is sometimes made that they contain more nutriment than the same quantity of beef. Reference to above table does not bear out such statement; they contain more starch but less protein. It is also claimed by some advertisers that breakfast foods are brain and nerve foods. The idea that certain foods are brain and nerve foods is erroneous, excepting that any tissue building food (protein) builds nerve and brain tissue as it builds any other tissue. There is a prevalent idea that fish and celery are brain food, but there is no scientific basis for the theory.

The grains commonly used for breakfast foods are corn, oats, rice, and wheat. Barley, and wild rice, millet and buckwheat are used in some sections but not enough

to warrant discussion here. Barley is used chiefly for making malt and pearled barley for soups.

The following table, from one of the bulletins published by the United States Department of Agriculture, is interesting from an economical standpoint.

TABLE VI.

Comparative cost of digestible nutrients and available energy in different cereal breakfast foods.

Food Materials	Price per pound	Cost of one pound of protein	Cost of 1,000 calories of energy	Amount for 10 cents				
				Total wgt. of. materi l	Pro-tien	Fat	Carbo-hy-drates	En-ergy
Oat preparations:								
Oatmeal, raw	3	0.24	1.7	3.33	0.42	0.22	2.18	5,884
Do	4	.32	2.3	2.50	.31	.16	1.64	4,418
Rolled oats, steam cooked	6	.48	3.4	1.67	.21	.11	1.08	2,938
Wheat preparations:								
Flour, Graham	4	.40	2.6	2.50	.25	.01	1.61	3,790
Flour, entire-wheat	5	.46	3.1	2.00	.22	.03	1.36	3,188
Flour, patent	3.5	.35	2.1	2.86	.29	.03	2.10	4,700
Farina	10	1.12	6.2	1.00	.09	.01	.73	1,609
Flaked	15	1.69	9.3	.67	.06	.01	.46	1,005
Shredded	12.5	1.62	8.2	.80	.06	.01	.57	1,217
Parched and ground	7.5	.88	4.9	1.33	.11	.02	.94	2,050
Malted, cooked and crushed	13	1.43	8.5	.77	.07	.01	.53	1,175
Flaked and malted	11	1.21	7.2	.91	.08	.01	.62	1,389
Barley preparations								
Pearled barley	7	1.06	4.6	1.43	.09	.01	1.04	2,165
Flaked, steam cooked	15	1.83	9.6	.67	.05	.....	.50	1,051
Corn preparations:								
Corn meal, granular	3	.44	1.8	3.33	.23	.06	2.48	5,534
Hominy	4	.62	2.4	2.50	.16	.01	1.97	4,178
Samp	5	.78	3.0	2.00	.13	.01	1.57	3,342

TABLE VI. (Continued)

Comparative cost of digestible nutrients and available energy in different cereal breakfast foods.

Food Materials	Price per pound	Cost of one pound of protein	Cost of 1,000 calories of energy	Amount for 10 cents: Total wgt. of materi'l	Pro-tein	Fat	Carbo-hy-drates	En-ergy
Flaked and parched	13	1.73	7.5	.77	.06	.01	.60	1,335
Rice preparations:								
Rice, polished	8	1.48	4.7	1.25	.07	.....	.94	1,855
Flaked, steam cooked	15	2.31	9.8	.67	.04	.....	.51	1,026
Miscellaneous foods for comparison:								
Bread, white	6	.74	5.0	1.67	.14	.02	.87	2,009
Do	5	.62	4.2	2.00	.16	.02	1.04	2,406
Crackers	10	1.10	5.3	1.00	.09	.08	.71	1,905
Macaroni	12.5	1.08	7.5	.80	.09	.01	.58	1,328
Beans, dried	5	.28	3.5	2.00	.35	.03	1.16	2,868
Peas, dried	5	.26	3.4	2.00	.38	.02	1.20	2,974
Milk	3	.94	9.7	3.33	.11	.13	.17	1,030
Do	3.5	1.09	11.3	2.86	.09	.11	.14	885
Sugar	5	.....	2.8	2.00	.....	.....	2.00	3,515
Do	6	.....	3.4	1.67	.....	.....	1.67	2,940

The less expensive breakfast foods, such as oatmeal and cornmeal, are as economical as flour, and, as they supply heat and energy in abundance, as shown by above table, they should be supplied in the diet in proportion to the energy required. They are easily prepared for porridge, requiring simply to be boiled in water, with a little salt.

For invalids, children and old people, breakfast foods prepared in gruels and porridges are valuable as they are easily

digested. All should be thoroughly cooked so as to break the cells enclosing the starch granules.

Predigested Foods. Some foods are claimed to be partly digested and thus valuable for those with weak stomachs, but breakfast foods are largely starch and the gastric juices are not active in the digestion of starch. It is digested by saliva and the ferment diastase in the intestines. (Diastase is a ferment of saliva and pancreatic juice, which changes starch into dextrin and maltose, in which form it is more easily acted upon by the intestinal juices.)

Experiments with "predigested" foods do not show a larger proportion of dextrin, however, than would naturally be produced by the heating of the starch, as these foods are being cooked at home. The natural cooking at home makes starch more or less soluble, or at least gelatinized. As a result of these experiments, therefore the "predigested" argument is not given much weight.

Predigested foods, excepting in cases so weak as to be under the direction of a physician, are not desirable. Nature requires every organ to do the work intend-

ed for it, in order to keep up its strength, just as she requires exercise for the arms or legs to keep them strong. If an organ is weak, the *cause* must be found and corrected,—perhaps the stomach or intestines need more blood which should be supplied through exercise; or perhaps the nerves need relaxation; or the stomach less food; or food at more regular intervals.

Another argument against predigested foods lies in the fact that dentists hold that the chewing of coarse food is necessary to keep the teeth strong. For this strengthening of the teeth, children are given dry crackers and dry toast each day.

In the so-called "predigested" or "malted" preparations, malt is added while they are being cooked. Malt is a ferment made from some grain, usually from barley, the grain being allowed to germinate until the ferment diastase is developed.

There is no doubt that a number of foods, containing malt are valuable in the hands of physicians to assist in converting starch into dextrin or sugar, where diastase is not formed in sufficient quantity, just as pepsin is an aid in the digestion of protein,—but eaten indiscriminately, there can be no question that it is more impor-

tant for the stomach and intestines to perform their natural work and thus keep their strength through normal exercise.

While they are not "predigested," as claimed, they are, as a rule, wholesome and nutritious. They are cleanly, and made from good, sound grain and they contain no harmful ingredients. Some contain "middlings," molasses, glucose and similar materials, but these are in no way injurious and have value as foods. The dry, crisp, ready-to-eat foods are especially advantageous because of the mastication they require,—this mastication insuring plenty of saliva being mixed with them to aid in digestion. A dish of such dry breakfast food, well masticated, together with an egg, to furnish a larger proportion of protein, makes a wholesome breakfast.

Cracked Wheat. In America wheat is seldom used whole. In England the whole grain, with the bran left on, is slightly crushed and served as cracked wheat or wheat grits.

Wheat is also rolled, or flaked, or shredded. The majority of wheat breakfast foods contain a part of the middlings and many of them bran. Farina and glu-

ten preparations do not contain these, however.

The preparations of the various breakfast foods are a secret of the proprietors. The ready-to-eat brands are cooked, then they are either rolled or shredded, the shredding requiring special machinery to tear the steamed kernels; later they are dried, and, finally packed, sometimes in small biscuits. Many preparations are baked after being steamed, which turns them darker and makes them more crisp. Some preparations are steamed, then run through rollers, while still wet, and pressed into flakes or crackers.

Oatmeals are the most nutritious cereals. The oat contains more fat than other grains and a larger proportion of protein. It is, therefore, the best adapted to sustain life in the proportion of nutrient elements. On account of the fat, oats are especially well adapted for a breakfast food in winter. Another advantage oatmeal, or rolled oats, have as a breakfast food is in their laxative tendency, due to the coarse shell of the kernel.

Oat breakfast foods keep longer than the foods made from wheat and rice.

There are no malts, or any mixtures in the oat preparations. The difference between the various oatmeal breakfast foods is in their manner of preparation. They all contain the entire grain, with the exception of the husk. They are simply the ground or crushed oat. In preparing the oats before grinding, the outer hull is removed, the fuzzy coating of the berry itself is scoured off, the ends of the berry, particularly the end containing the germ, which is usually the place of deposit for insect eggs, is scoured, and the bitter tip end of the oat berry is likewise removed.

Rolled oats consist of the whole berry of the oat, ground into a coarse meal, either between millstones, or, in the case of the so called "steel cut" oatmeal, cut with sharp steel knives across the sections of the whole oat groat.

Quaker Oats consist of the whole groat, which, after steaming in order to soften, have been passed between hot steel rolls, somewhat like a mangle in a laundry, and crushed into large, thin, partially cooked flakes. The oats are then further cooked by an open pan drying process. This roasting process insures that all germ life is exterminated, renders the product capable of quicker preparation for the

table and the roasting causes the oil cells to release their contents, thereby producing what is termed the "nut flavor," which is not present in the old fashioned type of oat product.

Both Rolled Oats and Quaker Oats are now partially cooked in their preparation but the starch cells must be thoroughly broken and they should be cooked at least forty-five minutes in a double boiler; or, a good way to prepare the porridge, is to bring it to the boiling point at night, let it stand covered over night and then cook it twenty to thirty minutes in the morning. Another method of cooking is to bring the porridge to the boiling point and then leave it in a fireless cooker over night.

The great fault in the preparation of any breakfast food is in not cooking it sufficiently to break the starch cells.

Puffed Rice is made from a good quality of finished rice. The process is a peculiar one, the outer covering, or bran, is removed and then the product is literally "shot from guns;" that is, a quantity of the rice is placed in metal retorts, revolved slowly in an oven, at high temperature, until the pressure of steam, as shown by gauge on the gun, indicates that the steam, gener-

ated slowly by the moisture within the grain itself, has thoroughly softened the starch cells. The gun retort is pointed into a wire cage and the cap which closes one end is removed, permitting an inrush of cold air. This cold, on striking the hot steam, causes expansion, which amounts practically to an explosion. The expansion of steam within each starch cell completely shatters the cell, causing the grain to expand to eight times its original size. It rushes out of the gun and into the cage with great force, after which it is screened to remove all scorched or imperfectly puffed grains.

This process dextrinizes a portion of the starch and also very materially increases the amount of soluble material as against the original proportion in the grain.

Puffed Wheat is manufactured from Durum, or macaroni wheat, of the very highest grade. This is a very hard, glutinous grain. It is pearled in order to thoroughly clean and take off the outer covering of bran. It then goes through a puffing process, identical with that of Puffed Rice. The chemical changes are very similar to those of puffed rice.

Both Puffed Rice and Puffed Wheat are more digestible than in the original grain state. They are valuable foods for invalids.

Stale Bread. A food which tastes much like a prepared breakfast food, but is cheaper, may be made by dipping stale bread into molasses and water, drying it in the oven for several hours, and then crushing it. It is then ready to serve with cream. This is a palatable way to use up stale bread.

Crackers and Milk or Bread and Milk. As noted by above table, crackers are similar to breakfast foods in nutrient elements, and with milk make a good food for breakfast, or a good luncheon. Business men, and others who eat hurriedly and return immediately to work, will do well to substitute crackers and milk, or bread and milk, for the piece of pie, which often constitutes a busy man's lunch.

Cereal Coffees

According to investigations made by the United States Agriculture Experiment Station, cereal coffees are made of parched grains. A few contain a little true coffee, but for the most

part they are made of parched wheat, barley, etc., or of grain mixed with wheat middlings, pea hulls, or corn cobs. There is no objection to any of these mixtures providing they are clean. The cereal coffees, as seen by the following table, contain no more nourishment than the true coffee, but they are probably more easily digested; only a very little of the soluble starch passes into the water. Coffee and tea are not taken for their nutrition, but for their stimulating effect upon the nerves; and, if stimulation is desired, the cereal coffees fall short.

TABLE VII.

Composition of cereal-coffee infusion and other beverages.

Kind of Beverage	Water	Protein	Fat	Carbohydrates	Fuel Value per pound
Commercial cereal coffee (0.5 ounce to 1 pint water)	98.2	0.2	.....	1.4	30
Parched-corn coffee (1.6 ounces to 1 pint water)	99.5	a.2	.....	.5	13
Oatmeal water (1 ounce to 1 pint water)	99.7	a.3	.....	.3	11
Coffee (1 ounce to 1 pint water)	98.9	.2	.....	.7	16
Tea (0.5 ounce to 1 pint water)	99.5	.2	.....	.6	15
Chocolate (0.5 ounce to 1 pint milk)	84.5	3.8	4.7	6.0	365
Cocoa (0.5 ounce to 1 pint water)	97.1	.6	.9	1.1	65
Skimmed milk	88.8	4.0	1.8	5.4	170

By reference to table VII it will be seen that cocoa and skimmed milk contain much

more nutrition than any of the coffees. Their chief value is that they furnish a *warm* drink with the meal. They should not be too hot.

Barley or wheat, mixed with a little molasses, parched in the oven, and then ground, makes about the same mixture as the cereal coffee.

The old fashioned crust coffee, made from bread crusts, toasted in the oven, is just as nutritious as any of the coffees and has the advantage of being cheaper.

Barley water and oat water, made by boiling the grain thoroughly and then straining, are nourishing foods for invalids and children. They are often used as drinks by athletes and manual laborers, as they have the advantage of both quenching thirst and supplying energy.

Gruels are made in the same way, only strained through a sieve. This process allows more of the starch to pass with the water.

Legumes

The legumes are the seeds of peas, beans, lentils and peanuts.

While they are seeds, just as the cereals are, they differ in that they contain a very much larger proportion of protein and may be substituted for meat or eggs

in a diet. In all vegetarian diets the legumes should be used freely to replace the meat.

All legumes must be thoroughly cooked and thoroughly masticated. Because the protein in these foods is more difficult of digestion than that in meat or eggs, particularly if not thoroughly masticated, they are better adapted for the use of men doing manual labor. Soldiers, day laborers, and others, whose work calls for physical exercise, can digest legumes, when those whose occupation is more sedentary can not do so.

TABLE VIII.—LEGUMES

Food Materials	Water Per Cent	Protien Per Cent	Fat Per Cent	Carbohydrates Per Cent	Ash Per Cent	Fuel Value per pound Calories
Dried Legumes:						
Navy beans	12.6	22.5	1.8	59.6	3.5	1,605
Dried Peas	9.5	24.6	1.0	62.0	2.9	1,655
Lentils	8.4	25.7	1.0	59.2	5.7	1,620
Lima beans	10.4	18.1	1.5	65.9	4.1	1,625
Peanuts	9.2	25.8	38.6	24.4	2.0	2,560
Peanut butter	2.1	29.3	46.5	17.1	5.0	2,825
Fresh Legumes:						
Canned peas	85.3	3.6	0.2	9.8	1.1	255
Canned lima beans	79.5	4.0	0.3	14.6	1.6	360
Canned string beans	93.7	1.1	0.1	3.8	1.3	95
Canned baked beans	68.9	6.9	2.5	19.6	2.1	600
String beans	89.2	2.3	0.3	7.4	0.8	195
Shelled peas	74.6	7.0	0.5	16.9	1.0	465

The protein of the legumes is of the same nature as the casein of milk. It has been called vegetable casein.

Peanuts. While an underground vegetable, grown like potatoes, peanuts resemble nuts, inasmuch as they contain so much oil. Like other legumes, they require cooking. They are roasted because this develops the flavor.

Because of the proportion of the chemical elements in peanuts, they will sustain life for an indefinite period, without other food, as they provide rebuilding material, energy and heat. Used alone, however, there is no counteracting acid, and it is better to add some fruit, such as apples, or apples and dates.

In eating peanuts it is imperative that they be masticated *until they are a pulp;* otherwise they are very difficult of digestion. The pain which many people experience, after eating peanuts, is probably due to eating too large a quantity and not fully masticating them, forgetting that they are a very rich, highly-concentrated food. Both peanuts and peanut butter contain over twenty-five per cent of protein and a much larger percentage of fat; therefore they yield much heat and energy.

Peanut Butter. While peanut butter contains forty-six and one half per cent fat, it contains only seventeen per cent carbohydrates. Since sugars and starches are protections to fat, being used for energy before the fats are consumed, if these sugars and starches are not supplied in other food, the fats in the peanut butter are consumed for energy. If starches *are* consumed in other foods, it is clear that one who wishes to reduce in flesh should avoid peanut butter, as well as other fats.

Peanut butter is more easily digested than the baked peanut, unless the latter is chewed to a pulp. It can be made at home by grinding the peanuts in a meat grinder and then further mashing with a rolling pin or a potato masher. A little lemon juice mixed with the peanut butter makes it not only more palatable, but more easily digested. A peanut butter sandwich is quite as nourishing as a meat sandwich.

Shelled Peas. Shelled peas were used in Europe as far back as in the Middle ages, and there, to-day, the dried or "split" pea is used quite as extensively as the dried bean. In America, peas are used almost entirely in the green stage, fresh or canned.

As seen by Table VIII, the green, shelled pea contains seven per cent protein and sixteen per cent sugar and starch, while the dry or "split" pea contains over twenty-four and a half per cent protein and sixty-two per cent sugar and starch, the difference being in the amount of water in the shelled peas. Canned peas contain even a larger per cent of water.

A variety of green peas is now being cultivated in which the pod of the pea is used, just as the pod of the string bean. It is a sweet and delicious side dish.

Dry Peas are used in this country only by boiling, putting through a sieve, and serving as puree.

Beans. Baked navy beans may well be substituted on a menu for meat, containing, as they do, twenty-two and one half per cent protein. It is needless to state that beans and lean meat or eggs should not be served at the same meal. Beans have the advantage of being cheaper than meat, yet, as stated above, the protein in the legumes is less easily digested than the protein of meat or eggs. They must be thoroughly cooked and thoroughly masticated.

There is but a small percentage of fat

in dried beans and for this reason they are usually baked with a piece of pork. They make a very complete, perhaps the most complete food, containing nutrient elements in about the proper proportions. Effort has been made to make a bean cracker for the sustenance of soldiers on a march, thus giving them a complete food in condensed form.

In baking dried beans or peas, soft or distilled water should be used, as the lime of hard water makes the shell almost indigestible. For the same reason salt should be added when the beans are nearly done. If soft water is not obtainable, add a little baking soda, in the proportion of a half a teaspoon to two quarts of water.

String Beans. The string bean contains very little nutrient elements, as shown by Table VIII. The pod and the bean, at this unripe stage, are nearly ninety per cent water. Their chief value as a food consists of their appetizing quality to those who are fond of them, thus stimulating the flow of gastric juice. Like all green vegetables, they stimulate the action of the kidneys. For this reason all green vegetables are particularly valuable to those who drink little water.

Lima Beans. The dry, shelled bean, used during the winter, boiled and baked is the lima bean.

Kidney Beans contain much water but are more nutritious than the string bean.

Soy Bean. In China and Japan this bean is used extensively. Being rich in protein, it makes a well balanced diet with rice.

The soy bean is made into various preparations, one of the most important being *shoyo,* now being introduced into other countries. To make it, the soy bean is cooked and mixed with roasted wheat flour and salt; into this is put a special ferment. It is then allowed to stand for years in casks. The result is a thick, brown liquid with a pungent, agreeable taste. It is very nourishing.

A kind of cheese is also made from boiling the soy bean for several hours, then wrapping the hot mass in bundles of straw, and putting it in a tightly closed cellar for twenty-four hours.

Lentils are not commonly used in this country, but they were one of the earliest vegetables to be cultivated in Asia and the Mediterranean countries. They are imported and are found only in the best mar-

kets of large cities. They are used in the menu like dried peas and are fully as nourishing, but the flavor of the lentil is pronounced and they are not as agreeable to the average person as peas or beans.

Nuts

Nuts are classed with the carbo-nitrogenous foods, because of the more nearly equal proportion of proteins and carbonaceous substances.

TABLE IX.—NUTS

Food Materials	Water Per Cent	Protein Per Cent	Fat Per Cent	Carbohydrates Per Cent	Ash Per Cent	Fuel Value per pound Calories
Almonds	4.8	21.0	54.90	17.3	2.0	3,030
Brazil nuts	5.3	17.0	66.80	7.0	3.9	3,329
Filberts	3.7	15.6	65.30	13.0	2.4	3,342
Hickory nuts	3.7	15.4	67.40	11.4	2.1	3,495
Pecans	3.0	16.7	71.20	13.3	1.5	3,633
English walnuts	2.8	16.7	64.40	14.8	1.3	3,305
Chestnuts, fresh	45.0	6.2	5.40	42.1	1.3	1,125
Walnuts, black	2.5	27.6	56.30	11.7	1.9	3,105
Cocoanut, shredded	3.5	6.3	57.30	31.6	1.3	3,125
Peanuts, roasted	1.6	30.5	49.20	16.2	2.5	3,177

It will be noted, by reference to the table, that nuts contain a much larger proportion of fats and less starch than the legumes. Chestnuts contain the largest amount of starch, pecans the most fat, and roasted peanuts the most protein.

Nuts are a valuable food, but they should be made a part of a meal and may well take the place of meat, because of the large percentage of protein, rather than to be eaten as a dessert. They are too hearty to eat at the end of a meal, after one has eaten as much other food as the system requires. In planning a meal, if the dietary is rich in starches and lacking in protein, a side dish of nuts may be served.

Too great stress cannot be laid upon the importance of the thorough mastication of nuts; otherwise they are difficult of digestion. When thoroughly chewed, however, they are as easily digested as cereals or legumes. If ground fine in a meat grinder or through a sieve, they digest more readily, but this grinding does not take the place of the grinding with the teeth and the mixing with saliva. They are best ground for salads, cake or croquettes.

Milk

Milk is called a complete food. It is a perfect food for the sustenance of its own species,—the milk of the cow for the calf, the mother's milk for the infant; yet the milk of the cow is not perfect for the child,—it is lacking in the proper proportion of sugar, and when fed to the child a little sugar is added.

There has been a tendency among certain classes, to recommend an all-milk diet, because the proteins, carbohydrates and fats are in proportion to sustain life indefinitely, but experiments have shown that healthy, digestive organs do their work better when a part of the food is solid. Moreover, if an all-milk diet were followed, the adult, in order to get sufficient nutriment, would be compelled to take a larger proportion of water than necessary, the proportion of water required by the system being about sixty-seven per cent, while milk contains eighty-seven per cent.

In order for the adult to get the proper quantity of carbohydrates and fat, from an all-milk diet, it would be necessary to drink from four to five quarts of milk a day (sixteen to twenty glasses). Therefore, although an exceedingly valuable food, containing nutriment elements for repair and to supply heat and energy for an indefinite time, *milk is not a desirable, perfect food for an adult.*

If the mother's milk contains eighty-seven per cent water it seems not too much for the infant. Young babies, on a milk diet, are almost always fat. This is not because the fats, sugars and starches are in too large a proportion to the protein,

but it bears out the theory, which is fully demonstrated in actual experiments of the writer with over twenty thousand women, that the free drinking of liquid at a meal aids digestion and a better absorption and assimilation of food.

One advantage of drinking milk with the meal, is that it is not taken as cold as water and it supplies a portion of actual food.

TABLE X.

Milk and Milk Products.

Food Materials	Water	Proteins	Fats	Sugar	Salts	Lactic Acid
Milk	86.8	4.0	3.7	4.8	0.7	......
Skimmed milk	88.0	4.0	1.8	5.4	0.8	......
Buttermilk	90.6	3.8	1.2	3.3	0.6	0.3
Cream	66.0	2.7	26.7	2.8	1.8	......
Cheese	36.8	33.5	24.3	......	5.4	......
Butter	6.0	0.3	91.0	......	2.7	......

Reference to the above table shows that the thirteen per cent of organic foods are about equally divided between fat, sugar and protein. The protein is *casein.* There is no starch in milk. The digestive ferment, which acts upon starch, has not developed in the young babe and the infant cannot digest starch. The salts promote the growth of bone.

The fat in milk is in small emulsified droplets within a thin albuminous sheath. When allowed to stand in a cool place it rises to the top.

Besides casein, there is a certain amount of albumen in milk,—about one-seventh of the total amount. This is called lactalbumin.

A part of the digestion of the casein is performed by pepsin in the stomach and a part by the trypsin of the pancreatic juice.

Digestion of Milk. The larger part of the digestion of the milk sugar is performed by the pancreatic juice; yet it is partly acted upon by the saliva. There is little chance for the saliva to act upon the milk sugar in the mouth, however, as very little saliva is mixed with the milk. This constitutes another objection to the diet of all milk, and is an argument in favor of drinking milk slowly and holding it in the mouth until it is mixed with saliva. It is one reason, also, why children should be given bread broken in the milk, instead of a piece of bread and a glass of milk. By swallowing the milk slowly, the curds formed in the stomach are smaller and the milk is more thoroughly digested.

When the fat (cream) is removed milk digests more readily, so that in case of

delicate stomachs *skimmed milk, clabbered milk or buttermilk* are often prescribed instead of sweet milk. Boiled milk is also more easily digested by some because of the lactalbumin which is separated and rises to the top in a crinky skum. The casein is also more readily digested in boiled milk, forming in small flakes in the stomach instead of in curds.

When one takes from two to three glasses of milk at a meal, less solid food is needed, because the required nutriment is partially supplied with the milk. One reason why milk seemingly disagrees with many people, is because they lose sight of the fact that milk is an actual food, as well as a beverage and they eat the same quantity of food in addition to the milk that they eat if drinking water. This is the reason that milk seems to make some people billious and causes constipation. It is due to too much food rather than to any quality in the milk.

Constipation may be occasioned by drinking milk rapidly so that large curds are formed by the acids in the stomach, rendering it difficult of digestion. The constipating effect will be overcome by lessening the quantity of food and by the addition of limewater to the milk.

To prepare limewater put a heaping teaspoon of slaked lime into a quart of boiled or distilled water; put into a corked bottle and shake thoroughly two or three times during the first hour. Then allow the lime to settle, and after twenty-four hours pour or siphon off the clear fluid.

Barley water or oatmeal water added to milk also prevent the formation of curds.

In young babes the milk is curdled, or the casein separated from the water and sugar, not by hydrochloric acid, but by a ferment in the gastric juice, known as rennin. It is the rennin, or rennet, from the stomachs of young calves and young pigs, which is used to coagulate the casein in cheese factories.

Milk is coagulated or curded by many fruit and vegetable acids, as the housewife well knows, using milk in pies containing certain acid fruits, such as lemons, or in soup containing tomatoes. The hydrochloric acid of the stomach at once causes a similar coagulation, though the curds are tougher and more leathery. The milk forms into curds immediately upon entering the stomach. This is the natural process of milk digestion and is the chief reason why it should be drunk slowly. otherwise the curds will form in too large

sizes, thus pressing upon the entrance to the stomach and causing distress. The tough, large curds formed by the hydrochloric acid, are difficult for invalids or for very delicate stomachs to digest.

If an alkali, such as limewater, is added, to neutralize the acids of the stomach, the curds do not form, or are re-dissolved, and digestion is aided. One sixth limewater to five-sixths milk is the proper proportion.

Milk Tests. In testing the value of milk, or the value of a cow, butter makers and farmers gauge it by the amount of butter fat in the milk, while the cheese maker tests the milk for the proportion of protein (casein). The amount of butter fat depends upon the feed and water, and upon the breed. The milk from Jersey and Guernsey cows yields about five per cent butter fat. If the total nutrient elements fall below twelve per cent, it is safe to assume that the milk has been watered.

In cheese and butter there is no sugar; it remains in the buttermilk and the whey, both of which the farmer takes home from the factories to fatten his hogs.

Preserving Milk. Many forms of bacteria thrive in milk and it is needless to say that the utmost cleanliness should be

observed on the part of the dairyman in the care and cleanliness of his cows, in the cleanliness of the milk receptacles, and in the place in which the milk is allowed to stand over night. Care and cleanliness in the home is quite as important.

If milk could be kept free from bacteria, it would keep sweet almost indefinitely. At the Paris Exposition, milk from several American dairies was kept sweet for two weeks, without any preservative, except cleanliness and a temperature of about forty degrees. The United States Bureau of Animal Industry states that milk may be kept sweet for seven weeks without the use of chemicals.

The best method for the housewife to follow is to keep the milk clean, cool, and away from other foods.

Pasteurized Milk. In pasteurizing milk the aim is to destroy as many of the bacteria as possible without causing any chemical changes or without changing the flavor. One can pasteurize milk at home by placing it in an air tight bottle, immersing the bottle to the neck in hot water, heating the water to one hundred and forty-nine degrees F for a half hour and then quickly cooling the milk to fifty degrees, by im-

mersing the bottle in cold water. The rapid cooling lessens the cooked taste. Many of the best dairies pasteurize the milk in this way before it is marketed.

Sterilized Milk. Milk is sterilized to destroy all bacteria, by boiling it. It must sometimes be boiled one, two or three successive days. Sterilized milk remains sweet longer than pasteurized milk, but more chemical changes are produced and the flavor is changed.

Formerly borax, boric acid, salicylic acid, formalin and salt petre were used to keep the milk sweet, but this adulteration is now forbidden by the pure food laws.

Malted Milk is a dry, soluble food product in powder form, derived from barley malt, wheat flour and cows milk, with the full amount of cream.

The process of the extraction from the cereals is conducted at elevated temperatures so as to allow the active agents (enzymes) of the barley malt to affect the conversion of the vegetable protein and starches. The filtered extract, containing the derivatives of the malt, wheat and the full-cream cows milk, is then evaporated to dryness in vacuo, the temperature being controlled so as to obviate any alteration of the natural constituents of the

ingredients and so as to preserve their full physiological values. The strictest precautions are observed to insure the purity of the product. It contains,

Fats	**8.75**
Proteins	**16.35**
Dextrine	**18.80**
Lactose and Maltose	**49.15**
(Total Soluble Carbohydrates)	**67.95**
Inorganic Salts	**3.86**
Moisture	**3.06**

It is free from germs, the starches and sugars being converted in the process of manufacture in maltose, dextrine and lactose. The fats are in an absorbable condition, and it contains a high percentage of proteins derived from both the milk and the grains, as well as a marked percentage of mineral salts. It is readily soluble in water and is easily digested.

Smierkase, made in the home, is coagulated casein. It contains thirty-three per cent protein, twenty-four per cent fat and five per cent salts. The thickening of the milk, or the coagulation of the casein, is like that produced by lactic acid.

Skimmed Milk, as shown by the table, contains the same amount of protein as fresh milk, but more sugar and more ash, the difference consisting almost entirely of less fat, which has been removed in the cream.

Buttermilk. There is less fat, protein, sugar or ash in buttermilk than in skimmed milk; it is therefore less nourishing but more easily digested. The sugar has partially fermented and the free lactic acid gives the pungent taste. Buttermilk made by lactone tablets and fresh milk is as nourishing and as desirable as that made in the process of butter making, and it has the advantage of being fresh.

Clabbered Milk. The casein in clabbered milk coagulates, and, if kept in a hot place, the coagulation continues until the water, sugar and salt are separated. This is the whey, which is fed to hogs,—the sugar fattens them.

Milk Sugar. Sugar made from milk is now a commercial factor; it is evaporated and compressed into a fine powder. This powder is used by physicians and druggists in mixing powders, pills, tablets, etc.

Milk Junket. The junket tablets, used in milk junket, are milk coagulated by rennet. Flavored milk coagulated by rennet, has not the sour taste of milk coagulated by acid.

Condensed Milk is made by evaporating the water until the milk is reduced to about one fourth its volume. It is then sterilized and hermetically sealed. It is convenient

for use, wherever fresh milk cannot be obtained, but the process of evaporation changes its flavor so that few care for it as a drink. It makes a good substitute for cream in coffee, and diluted with three times its volume in water, it is again of the same constituency as before the water was evaporated.

BEVERAGES

Tea

Tea is made by steeping the leaves of a shrub, which grows in the tropical regions of Asia and adjacent islands. The green tea comes from China and Japan and the darker varieties from India and Ceylon.

It should never be boiled nor allowed to stand longer than a few minutes, as standing in water causes tannin to be extracted from the leaves, and this tannin disturbs digestion. It is the tannin extracted from the bark of trees which toughens animal skins into leather. The best way to make tea is to pour on boiling water and serve almost immediately, or at least within five to ten minutes.

Because of the uncertainty as to the length of time tea may be allowed to steep in hotel kitchens or restaurants, it is a wise custom to have a ball of tea and a pot of hot water served that the guest may make the tea at the table.

Tea, as well as coffee, is diuretic—stimulating the action of the kidneys. It is not a *food;* it is a *stimulant.*

Thein, which is the ingredient for which tea is drunk, is chemically identical with caffein in coffee.

Coffee

Coffee is a beverage, prepared from the seeds of the coffee tree. The best known brands come from the Island of Java, Mocha, Rio de Janeiro, and Mexico.

Coffee *is not a food.* The active principle is caffein. This is an alkaloid and is a strong stimulant to the central nervous system. It quickens the heart action, and, unless the heart be weak, one does not need so strong a stimulant. The stimulating effect is so apparent with many, that they cannot sleep for several hours after drinking it. Others drink coffee to quicken mental activity and to keep them awake.

It must be borne in mind, however, that there is a reactionary effect from all stimulants, and while coffee is not intoxicating, as alcohol, it has a similar effect upon the nerves and heart. It is given to those addicted to liquor, as a milder stimulant, when they are recovering from a spell of intoxication.

Whether because of the strong stimulant, or because of some chemical effect of caffein, coffee retards digestion, especially when the digestive organs are weak. It has the redeeming feature, of having a pleasing aroma, which, because of the effect upon the mind, may incite the flow of gastric juice; but, despite the fact that no morning beverage has quite the same pleasing aroma, or pungency, as coffee, one is much better without it.

One who knows that coffee disturbs his digestion and yet cannot break himself from the habit of drinking it, should have sympathy for the one who is addicted to liquor and finds it difficult to break the habit of depending upon this *so-called* stimulant.

Cereal Coffee has been discussed under the heading "Cereals."

Cocoa and Chocolate

Cocoa and Chocolate are prepared from the chocolate bean. Cocoa is from the shell of the bean and chocolate from the kernel. As shown by Table VII, they are more nutritious than the other beverages; yet the fat in chocolate is not like the fat in other foods. It is not used as a reserve in animal tissue as are the other fats.

The active principle in cocoa and chocolate is *theobromin* and is similar to caffein in its stimulating effect upon the nervous system, though milder.

Lemonade

Lemonade and other fruit drinks, particularly those made from the citrous fruits, slake the thirst more quickly than most drinks.

All fruit drinks are diuretic, and, whereever the action of the kidneys is sluggish, they are especially desirable.

Carbonized Drinks

are made from bottling some drink, and, before sealing, forcing carbon dioxid into the bottle under pressure. As soon as the cork is removed the escape of the gas causes effervescence. These drinks have no advantage, other than that they slake the thirst.

Water

There is no beverage nor concoction devised by man equal to water. It is to be deplored that it is not used as freely as Nature demands,—from eight to ten glasses a day.

The value of water as a food and as an aid to digestion is discussed on page 41.

CONDIMENTS

Without doubt, highly spiced foods are undesirable. They tend to weaken digestion, by calling for an undue secretion of digestive juices, which, if prolonged, tires out the glands. A reasonable amount of condiments such as pepper, nutmeg, cloves, allspice, sage, thyme, ginger, mustard, cinnamon, mace, horseradish, vanilla, dill, etc., may be used as appetizers, because the pleasing thought of them may incite the flow of gastric juice; but if one has not cultivated a taste for them this thought will not be pleasing and they are then better omitted from the diet. The taste is undoubtedly a cultivated one, and should not be encouraged in children. The child rarely cares for condiments and it is better that he continue to relish his food for its natural flavor.

Condiments are not foods.

PRESERVATION OF FOODS

All food for preservation should be kept in a clean, cool, dry, dark place. Reduction in temperature to near freezing, and removal of moisture and air stop bacterial development.

Drying, cooking, and sealing from the air will preserve some meats and fruits, while others require such preservatives as sugar, vinegar and salt. The preservative in vinegar is acetic acid.

All preservatives which are actual foods, such as sugar, salt and vinegar, are to be recommended, but the use of antiseptic preservatives, such as salicylic acid, formaldehyd, boracic acid, alum, sulphur and benzonate of soda, all of which have been used by many canning merchants, is frought with danger. The United States Department of Agriculture holds, that by the use of such preservatives, unscrupulous dealers may use fruits and vegetables not in good condition.

There can be no doubt that, wherever possible, the best method for the housewife to preserve food is to do her own drying, canning, preserving and pickling of fruits and vegetables, which she knows are fresh, putting up her own preserves, jams, jellies, pickles, syrups, grape juice, etc.

Since economy in food lies in the least amount of money for the greatest amount of nutriment, the preparation of simple foods in the home, with a care that no more is furnished for consumption than the system requires, is the truest economy in health and in doctor's bills.

It is not more brands of prepared food which are needed, but purity of elements in their natural state. A dish of wholesome, clean oat meal has more nourishment and more fuel value than the average prepared food.

In the effort to emphasize the importance of pure food in amount and quality, pure air and pure water must not be overlooked. Much infection is carried by these two elements. Pure air, containing a normal amount of oxygen, is absolutely necessary that the system may digest and assimilate the foods consumed.

COOKING

The cooking of food is as important as its selection, because the manner of cooking makes it easier or more difficult of digestion. The question of the proper selection and cooking of food is so vital to the health and resultant happinees of every family, and to the strength and well being of a nation, that every woman, to whom the cooking for a family is entrusted, should have special preparation for her work, and every girl should be given practical and theoretical training in Dietetics in our public schools. The study is as dignified as the study of music and art. Indeed it can be made an art in the highest conception of the term. Surely the education of every girl in the vocation, in which she sooner or later must engage, either actively or by directing others, means more than education in music and drawing. We must all eat two and three times every day; there are few things which we do so regularly

and which are so vital; yet in the past we have given this subject less study than any common branch in our schools. When the dignity of the profession of dietetics is realized, the servant problem will be largely solved.

In cooking any food, heat and moisture are necessary, the time varying from thirty minutes to several hours, according to different foods. Baked beans and meats containing much connective tissue, as boiling and roasting cuts, require the longest time.

The purposes in the cooking of foods are: the development of the flavor, which makes the food appetizing, thus encouraging the flow of gastric juice; the sterilization, thereby killing all parasites and micro-organisms, such as the tape worm in beef, pork, and mutton, and the trichinae in pork; the conversion of the nutrients into a more digestible form, by partially or wholly converting the connective tissue into gelatin.

Cooking of Meats

The fundamental principle to be observed in the cooking of meat concerns the retention of the juices, since these contain a large part of the nutrition. The heat develops the fla-

vor, and the moisture, together with the heat, dissolves the connective tissue and makes it tender.

A choice piece of meat may be toughened and made difficult of digestion, or a tough piece may be made tender and easy to digest, by the manner of cooking.

Soups. To make meat soups, the connective tissue, bone and muscle should be put into cold water, brought *slowly* to the boiling point and allowed to simmer for hours. It must be remembered that the gelatin from this connective tissue does not contain the tissue building elements of the albuminoids. These are retained in what meat may be about the bones of the boiling piece and in the blood.

The albumin of meat is largely in the blood and it is the coagulated blood which forms the scum on soup, if heated above a certain point; the cook should boil the soup slowly, or much of the nutrition is lost in the coagulated blood, or skum.

Roasting. The flavor and juice of the meat is best retained by roasting. If it is put into a hot oven, with a little suet over the top, so as to sear the meat with hot fat, and no water is put in the pan, it will

retain the juice and the flavor. Water draws out the extractives.

It is important to remember that the smaller the cut to be roasted, the hotter should be the fire. An intensely hot fire coagulates the exterior and prevents the drying up of the meat juice. After the surface is coagulated and seared it should cook slowly.

Unless the oven is sufficiently hot to sear the surface, the moisture, or juice, will escape into the roasting pan and the connective tissue will be toughened. A roast should be cooked in a covered roaster to retain the moisure.

The roast should be turned as soon as one side is seared and just sufficient water put into the pan to keep it from burning.

Frequent basting of a roast, with the fat, juice, and water in the roasting pan, still further sears the surface, so that the juices do not seep through and keeps the air in the pan moist; the heated moisture materially assists in gelatinizing the connective tissue,—roasting pans are now made which are self-basting.

Broiling. The same principle applies to broiling as to roasting. The meat is put over a very hot flame and turned so as to

quickly sear both sides, to prevent the juice from oozing out. In fact, the best broiled steaks are turned just as soon as the juice begins to drip, so as to retain all juice in the meat.

Meat containing much connective tissue is not adapted to broiling, because it takes too long for this tissue to become gelatinized.

Steak broiled in a skillet, especially round steak which has been pounded to assist in breaking the connective tissue, is often first dipped in seasoned flour, which is rubbed well into it. The flour absorbs the meat juices so that none of them are lost. All meats broiled in skillets should be put into a very hot skillet and one surface seared, then should be turned so as to sear the other side. The skillet should be kept covered so as to retain the moisture.

Boiling. In boiling meat, where the object is to eat the tissue itself, it should be put into hot water, that the albumin on the surface may be immediately coagulated and prevent the escape of the nutrients into the water. It is impossible to make a rich broth and to have a juicy, highly flavored piece of boiled meat at the

same time. Meat is best roasted or broiled when the meat tissue is to be eaten.

The boiling cuts contain more connective tissue, therefore they require a much longer time to cook in order to gelatinize this tissue. They are not as rich in protein as the steaks.

Meat soups, bouillons and broths contain very little nutriment, but they do contain the extractives, and the flavors increase the flow of digestive juices and stimulate the appetite. It is for this reason that soups are served before a meal rather than for a dessert; they insure a copious flow of gastric juice and saliva to act upon the crackers or toast eaten with the soup. Many mistake the extractives and flavor for nourishment, feeling that the soups are an easy method of taking food, but the best part of the nutriment remains in the meat or vegetables making the soup.

Pot Roasts. In the case of a pot roast, or roast in a kettle, where it is desirable to use both the fibre of the meat and the juice, or gravy, it should be put into a little cold water and raised to about 180 degrees F., where it should be kept for some hours. The juices of the meat seep out in the

gravy. The extractives are simmered down and are again poured over the meat in the rich gravy.

Frying. This is the least desirable method of cooking. Food cooked by putting a little grease into a frying pan, such as fried potatoes, mush, eggs, french toast, and griddle cakes, are more difficult of digestion than foods cooked by any other means, particularly where the fat is allowed to smoke. The fat is superheated; if a lighted match is placed near the smoke it will catch fire, showing that it is volatilizing, or being reduced to a vapor.

The extreme heat liberates fatty acids. This acrid fat soaks into the food and renders it difficult of digestion. It is wise not to employ this method of cooking.

The objection to frying does not hold so strongly in the case of vegetables, such as potatoes, if fried *slowly* in fat, that is not over heated, or to griddle cakes cooked slowly without smoke, or to foods immersed in grease (such as saratoga chips, doughnuts, french fried potatoes, etc.), as the large amount of fat does not permit it to get so heated. It does apply, however, if the fat is sufficiently heated to smoke.

The coating of vegetables and cereals with the hot fat prevents the necessary action of saliva upon the starch globules. As previously stated, most of the starches are digested in the mouth and the stomach, while the fats are not emulsified until they reach the intestines.

The starch globules in cereals and vegetables are in the form of cells, the covering of these cells being composed largely of nitrogenous matter. The protein is not acted upon by the saliva, and the nitrogenous matter is largely digested in the stomach. It is more easily dissolved if it is broken or softened by cooking, so that the carbohydrates can come in contact with the saliva, but if encased in fried fat, the gastric juices cannot digest the protein covering and the saliva cannot reach the starch until the fat is emulsified in the intestines. This means that wherever starch globules are surrounded with fat, the digestive ferments reach these globules with difficulty and fried foods must be digested mostly in the intestines.

Fats are readily absorbed in their natural condition, but when subject to extreme heat, as in frying, they are irritants. For this reason, eggs, poached, boiled or baked are more easily digested than fried.

Boiling, broiling and roasting are preferable to foods cooked in fats.

Cooking of Cereals

One safe rule for the cook is, that it is better to cook most foods too much than too little; overcooking is uncommon and harmless, while *under*-cooked foods are common and difficult of digestion.

In partially cooked cereals, one does not know how much of the cooking has been done, but it is safe to cook all such foods at least as long as specified in the directions.

One reason why breakfast foods, such as rolled oats, are partially cooked, is because they keep longer.

As has been stated, the nutrients of the grain are found inside the starch-bearing and other cells, and the walls of these cells are made of crude fiber, on which the digestive juices have little effect. Unless the cell walls are broken down, the nutrients can not come under the influence of the digestive juices until the digestive organs have expended material and energy in trying to get at them. Crushing the grain in mills, and making it still finer by thorough mastication breaks many of the cell walls, and the action of the saliva and other di-

gestive juices also disintegrates them more or less, but the heat of cooking accomplishes the object much more thoroughly. The invisible moisture in the cells expands under the action of heat, and the cell walls burst. The water added in cooking also plays an important part in softening and rupturing them. Then, too, the cellulose itself may be changed by heat to more soluble form. Heat also makes the starch in the cells at least partially soluble, especially when water is present. The solubility of the protein is probably, as a rule, somewhat lessened by cooking, especially at higher temperatures. Long, slow cooking is therefore better, as it breaks down the crude fiber and changes the starch to soluble form without materially decreasing the solubility of the protein.

"In experiments made with rolled oats at the Minnesota Experiment Station, it appeared that cooking (four hours) did not make the starch much more soluble. However, it so changed the physical structure of the grains that a given amount of digestive ferment could render much more of it soluble in a given time than when it was cooked for only half an hour.

"On the basis of the results obtained, the difficulty commonly experienced in di-

gesting imperfectly cooked oatmeal was attributed to the large amounts of glutinous material which surrounds the starch grains and prevent their disintegration. When thoroughly cooked the protecting action of the mucilaginous protein is overcome, and the compound starch granules are sufficiently disintegrated to allow the digestive juices to act. In other words, the increased digestibility of the thoroughly cooked cereal is supposed to be largely due to a physical change in the carbohydrates, which renders them more susceptible to the action of digestive juices."

Pastry. Pastry owes its harmful character to the interference of fat as shown on page 198, with the proper solution of the starch,—at least such pastry as requires the mixing of flour with fat; the coating of these granules with fat prevents them from coming in contact with liquids; the cells cannot absorb water, swell and burst so that they may dissolve. The fat does not furnish sufficient water for this and so coats the starch granules as to prevent the absorption of water in mixing, or of the saliva in mastication. This coating of fat is not relieved until late in the process of digestion, or until the food

reaches the intestines. This same objection applies to rich gravies, unless the flour be dissolved in water and heated before being mixed with the fats. The objection, therefore, is to such pastry as is made by mixing flour with fat, as in pie crust; it does not apply to most puddings.

Heat, in cooking, causes a combustion of the carbonic acid gas and the effort of this gas to escape, as well as the steam occasioned by the water in the food, causes the bubbles. When beaten eggs are used, the albuminoids in the bubbles expand the walls, which stiffen with the heat and cause the substances containing eggs to be porous.

Cooking of Vegetables

Since the root vegetables contain a large proportion of carbohydrates, they should be well cooked, in order that the cells may be fully dissolved, and the crude fibre broken.

Vegetables are best cooked in soft water, as lime or magnesia, the chemical ingredients which make water "hard", make the vegetables less soluble.

Vegetables and fruits become contaminated with the eggs of numerous parasites from the fertilizers used; hence they should be thoroughly washed.

The objection to frying meats are equally strong in regard to vegetables. The coating of vegetables with the hot fat retards digestion, as shown on page 198.

Cooking of Fruit

"In different countries opinions differ markedly regarding the relative wholesomeness of raw and cooked fruit. The Germans use comparatively little raw fruit and consider it far less wholesome than cooked fruit. On the other hand, in the United States raw fruit of good quality is considered extremely wholesome, and is used in very large quantities, being as much relished as cooked fruit, if indeed it is not preferred to it. It has been suggested that the European prejudice against raw fruit may be an unconscious protest against unsanitary methods of marketing or handling and the recognition of cooking as a practical method of preventing the spread of disease by fruit, accidentally soiled with fertilizers in the fields or with street dust.

"As in the case with all vegetable foods, the heat of cooking breaks down the carbohydrate walls of the cells which make up the fruit flesh, either because the moisture or other cell contents expand and rupture the walls or because the cell wall is itself

softened or dissolved. Texture, appearance, and flavor of fruit are materially modified by cooking, and, if thorough, it insures sterilization, as in the case of all other foods. The change in texture often has a practical advantage, since it implies the softening of the fruit flesh so that it is more palatable and may be more readily acted upon by the digestive juices. This is obviously of more importance with the fruits like the quince, which is so hard that it is unpalatable raw, than it is with soft fruits like strawberries. When fruits are cooked without the addition of water or other material, as is often the case in baking apples, there is a loss of weight, owing to the evaporation of water, and the juice as it runs out carries some carbohydrates and other soluble constituents with it, but under ordinary household conditions this does not imply waste, as the juice which cooks out from fruits is usually eaten as well as the pulp. Cooking in water extracts so little of the nutritive material present that such removal of nutrition is of no practical importance.

"The idea is quite generally held that cooking fruit changes its acid content, acid being sometimes increased and sometimes

decreased by the cooking process. Kelhofer showed that when gooseberries were cooked with sugar, the acid content was not materially changed, these results being in accord with his conclusions reached in earlier studies with other fruits. The sweeter taste of the cooked product he believed to be simply due to the fact that sugar masks the flavor of the acid.

"It is often noted that cooked fruits, such as plums, seem much sourer than the raw fruit, and it has been suggested that either the acid was increased or the sugar was decreased by the cooking process. This problem was studied by Sutherst, and, in his opinion, the increased acid flavor is due to the fact that cooked fruit (gooseberries, currants, plums, etc.) usually contains the skin, which is commonly rejected if the fruit is eaten raw. The skin is more acid than the simpler carbohydrates united to form a complex carbohydrate. In some fruits, like the apple, where the jelly-yielding material must be extracted with hot water, the pectin is apparently united with cellulose as a part of the solid pulp. As shown by the investigations of Bigelow and Gore at the Bureau of Chemistry, 40 per cent of the solid material of apple pulp

may be thus extracted with hot water, and consists of two carbohydrates, one of which is closely related to gum arabic. That such carbohydrates as these should yield a jelly is not surprising when we remember that they are similar to starch in their chemical nature, and, as every one knows, starch, though insoluble in cold water, yields when cooked with hot water a large proportion of paste, which jellies on cooling.

"When fruits are used for making pies, puddings, etc., the nutritive value of the dish is, of course, increased by the addition of flour, sugar, etc., and the dish as a whole may constitute a better balanced food than the fruit alone."*

* C. F. Langworthy, Ph. D.—In charge of Nutritive Investigations of the United States Experiment Station.

DIETS

As previously stated, the object of foods is to supply the needs of the body in building new tissue in the growing child; in repairing tissue which the catabolic activity of the body is constantly tearing down and eliminating; and in supplying heat and energy. This heat and energy is not alone for muscular activity in exercise or movement; it must be borne in mind that the body is a busy workshop, or chemical laboratory, and heat and energy are needed in the constant metabolism of tearing down and rebuilding tissue and in the work of digestion and elimination.

In this chapter, a few points given in the preceding pages are repeated for emphasis. The proteins, represented in purest form in lean meat, build tissue and the carbonaceous foods, starches, sugars and fats, supply the heat and energy. An excess of proteins, that is more than is needed for building and repair, is also used for heat

and energy; the waste products of the nitrogenous foods are broken down into carbon dioxid, sulphates, phosphates, and other nitrogenous compounds and excreted through the kidneys, skin, and the bile, while the waste product of carbonaceous foods is carbon dioxid alone and is excreted mostly through the lungs.

Since the foods richest in protein are the most expensive, those who wish to keep down the cost of living, should provide, at most, no more protein than the system requires. The expensive meat may be eliminated and proteins be supplied by eggs, milk, legumes, nuts and cereals.

The most fundamental thing is to decide upon the amount of protein—two to four ounces, nearly a quarter of a pound a day—and then select a dietary which shall provide this and also supply heat and energy sufficient for the day. If the diet is to include meat, a goodly proportion of protein will be furnished in the lean meat. This will vary greatly with the different cuts of meat as shown on Table IV, page 128. If, as often happens, one does not care for fats, then the starches and sugars must provide the heat. If one craves sweets, less starches and fats are needed.

The normally healthy individual is more liable to supply too much protein than too little, even though he abstain from meat. Yet, as will be shown later, our strongest races, who have lent most to the progress of the world, live upon a mixed diet.

If the diet is to include meat, it will consist of less bulk, because the protein is more condensed; for the same reason, if it includes animal products of eggs and milk and a fair proportion of legumes, it will be less bulky than a vegetable diet. This point is important for busy people, who eat their meals in a hurry and proceed at once to active, mental work. Those who engage in physical labor are much more likely to take a complete rest for a half hour, to an hour, after eating. The *thinkers* seldom rest, at least after a midday meal, and those who worry seldom relax the mental force during any waking hours.

Where the system shows an excess of uric acid, the chances are that the individual has not been living on a diet with too large a proportion of protein, but that he has been eating more than he requires of all kinds of foodstuffs. His system thus becomes weakened and he does not breathe deeply nor exercise sufficiently to oxidize and throw off the waste. Let it be recalled

here that the theory that rheumatism is caused by an excess of uric acid is disputed by the highest authorities. It is *accompanied* by uric acid, but not supposed to be caused by it.

Every housewife, to intelligently select the daily menus for her family, needs a thorough knowledge of dietetics. She must understand the chemistry of food that she may know food values. The difficulty which confronts the housewife, is to provide one meal suited to the needs, tastes, or idiosyncracies of various members of her household. Peculiarities of taste, unless these peculiarities have been intelligently acquired, may result in digestive disturbances. As an illustration: one may cultivate a dislike for meat, milk, or eggs, as is often the case, and the proteins for the family being largely supplied by these, the individual is eating too much of starches and sugars and not sufficient protein,—legumes, nuts, etc., not being provided for one member. Such an one's blood becomes impoverished and she becomes anaemic.

The relief lies in *cultivating a taste* for blood building foods. Foods which are forced down, with a mind arrayed against

them, do not digest as readily, because the displeasure does not incite the flow of gastric juices. One fortunate provision of nature lies in the ability to cultivate a taste for *any* food. Likes and dislikes are largely mental. There are certain foods which continuously disagree and they should be avoided; but many abstain from wholesome food because it has disagreed a *few* times. It may be that it was not the particular food but the weakness of the stomach at this time. Any food fails of prompt digestion when the nerves controlling the stomach are weak.

Many foods disagree at certain times because of the particular conditions regulating the secretion of digestive juices. Where this condition has continued for some time it becomes chronic and a special diet is required, together with special exercises to bring a better blood supply to stomach and intestines and to regulate the nerves controlling them.

Dr. W. S. Hall estimates that the average man at light work requires, each day, 106.8 grams of protein*
57.97 grams of fat
398.84 grams of carbohydrates

* For table of weights see Appendix.

These elements, in proper proportions, may be gained through many food combinations. He gives the following:

Bread	1 lb.
Lean Meat	1/2 lb.
Oysters	1/2 lb.
Cocoa	1 oz.
Milk	4 oz.
Sugar	1 oz.
Butter	1/2 oz.

A medium sized man at out of door work, fully oxidizes all waste of the system and he requires a higher protein diet,—125 grams. In such event he does not require so much starch and sugar. If on the other hand he were to take but 106.8 grams of protein, as above, he would require more carbohydrates. One working, or exercising in the fresh air, breathes more deeply and oxidizes and eliminates more waste, hence he has a better appetite, which is simply the call of nature for a re-supply of the waste.

In active work, one also liberates more heat, thus more fat, starches, and sugar are required for the re-supply. If one has an excess of starch (glycogen) stored in the liver, or an excess of fat about the

tissues, this excess is called upon to supply the heat and energy when the fats and carbohydrates daily consumed are not sufficient for the day's demand. This is the principle of reduction of flesh.

It is interesting to note that habits of combining foods are unconsciously based upon dietetic principles. Meats rich in protein are served with potatoes, or with rice, both of which are rich in starch. Bread, containing little fat, is served with butter. Beans, containing little fat, are cooked with pork. Starchy foods of all kinds are served with butter or cream. Macaroni, which is rich in starch, makes a well balanced food cooked with cheese.

Pork and beans,
bread and butter,
bread and milk,
chicken and rice,
macaroni and cheese,
poached eggs on toast, and
custards, form balanced dishes.

A knowledge of such combinations is important when one must eat a hasty luncheon and wishes to supply the demands of the body in the least time, giving the least thought to the selection; but hasty

luncheons, with the mind concentrated upon other things, are to be strongly condemned. The mind must be relaxed and directed to pleasant themes during a meal or the nerves to the vital organs will be held too tense to permit a free secretion of digestive juices. Chronic indigestion is sure to result from this practice. Dinner, or the hearty meal at night, rather than at noon, is preferable for the business or professional man or woman, because the cares of the day are over and the brain force relaxes. The vital forces are not detracted from the work of digestion.

Experiments in the quantity of food actually required for body needs, made by Prof. R. H. Chittenden of the Sheffield Scientific School, Yale University, have established, beyond doubt, the fact that the average individual consumes very much more food than the system requires. In fact, most tables of food requirements, in previous books on dietetics, have been heavy.

Prof. Chittenden especially established the fact that the average person consumes more protein than is necessary to maintain a nitrogenous balance. It was formerly held that the average daily metabolism and excretion of nitrogen through the kidneys

was 16 grams, or about 100 grams of protein or albuminoid food. Prof. Chittenden's tests, covering a period of six months, show an average daily excretion of 5.86 grams of nitrogen, or a little less than one-third of that formerly accepted as necessary; 5.86 grams of nitrogen corresponds to 36.62 grams of protein or albuminoid food.

Prof. Chittenden's experiments of the foodstuffs actually required by three groups of men, one group of United States soldiers, a group from the Yale College athletic team, and a group of college professors, all showed that the men retained full strength, with a higher degree of physical and mental efficiency, when the body was not supplied with more protein than was liberated by metabolic activity, and when the quantity of carbonaceous food was regulated to the actual requirement to retain hody heat and furnish energy.

It may be well to call attention here to the fact that the food elements, called upon for work, are not from those foods just consumed or digested, but from those eaten a day or two previous, which have been assimilated in the muscular tissues.

In selecting a diet, the individual must be considered as to age, sex and physical

condition, also whether active in indoor or outdoor work, and whether he or she breathes deeply, so as to take plenty of fresh air into the lungs.

The following tables, published through the courtesy of Dr. W. S. Hall, give the rations for different conditions.

TABLE XI.

Rations for Different Conditions.

Conditions	Proteins Low	Proteins High	Fats	Carbo-hydrates Low	Carbo-hydrates High	Energy in Calories
Man at light indoor work	60	100	60	390	450	2764
Man at light outdoor work	60	100	100	400	460	2940
Man at moderate outdoor work	75	125	125	450	500	3475
Man at hard outdoor work	100	150	150	500	550	4000
Man at very hard outdoor winter work	125	180	200	600	650	4592
U. S. Army rations	64	106	280	460	540	4896-5032
U. S. Navy rations	....	143	292	557	....	5545
Football team (old regime)	....	181	292	557	....	5697
College football team (new)	125	125	125	500	....	3675

TABLE XII.

Rations Varied for Sex and Age.

Variations of Sex and Age	Proteins Low	Proteins High	Fats	Carbo-hydrates Low	Carbo-hydrates High	Energy in Calories
Children, two to six	36	70	40	250	325	1520-1956
Children, six to fifteen	50	75	45	325	350	1923-2123
Women, with light exercise	50	80	80	300	330	2272
Women, at moderate work	60	92	80	400	432	2720
Aged women	50	80	50	270	300	1870
Aged men	50	100	400	300	350	2258

The unit of measurement for the calories of energy is the amount of heat required to raise the temperature of one kilogram of energy to 1° centigrade.

In estimating the number of calories of energy given off by the different foods, Dr. Hall represents

1 gram of	carbohydrates	as 4.0	calories
" " "	fats	" 9.4	"
" " "	proteins	" 4.0	"

To determine the relative energy which a food represents, it is only necessary to multiply the number of grams of protein in that food by 4, the fat by 9.4 and the carbohydrates by 4, and add the results.

Thus according to the food required for the average man at light work given on page 211.

106.8 grams of proteins	x 4	= 427.20	calories of energy
57.97 " " fat	x 9.4	= 544.94	" " "
398.84 " " carbohydrates	x 4	= 1595.36	
		2567.51	= the calories of

energy required for the average man at light work.

Dr. Chittenden's experiments show that a man leading a very active life, and above the average in body weight, can maintain his body in equillibrium indefinitely with a daily intake of 36 to 40 grams of protein, or albuminoid food, and with a total fuel value of 1600 calories. Authorities, how-

ever differ upon the amount of food required.

Dr. Hall suggests	**106 grams of protein**
Ranke suggests	**100 grams of protein**
Hultgren and Landergren suggests	**134 grams of protein**
Schmidt suggests	**105 grams of protein**
Forster and Moleschott suggests	**130 grams of protein**
Atwater suggests	**125 grams of protein**

In order to bring oneself to as limited a diet as Prof. Chittenden's men followed, however, it would be necessary to have all food weighed so as to be sure of the correct proportions; otherwise the actual needs would not be supplied and the body would suffer. A wise provision of nature enables the body to throw off an excess of food above the body needs without injury, within limitations; but, as stated, there is no doubt that the average person exceeds these limits, exhausting the digestive organs and loading the system with more than it can eliminate; the capacity for mental work is restricted, and the whole system suffers.

Prof. Chittenden's experiments have been a wonderful revelation to dietitians and scientists. They have demonstrated beyond doubt that the average person eats much more than the system requires and thus overworks the digestive organs.

Mixed Diet versus a Vegetable Diet

From the fact that only from two to four ounces of nitrogenous food is required to rebuild daily tissue waste, it is apparent that this amount can readily be supplied from the vegetable kingdom, since nuts, legumes, and cereals are rich in proteins; yet there is a question whether a purely vegetable diet is productive of the highest physical and mental development. Natives of tropical climates live upon vegetables, fruits, and nuts, and it may be purely accidental or be due to climatic or other conditions, that these nations have not been those who have made the greatest progress in the world. Neither have the Eskimos, who live almost entirely upon meat, attained the highest development. The greatest progress and development, both as nations and as individuals, have been made by inhabitants of temperate climates, who have lived upon a mixed diet of meat, eggs, milk, grains, vegetables, fruits, and nuts. They have shown more creative force, which means reserve strength.

The Eskimo has demonstrated, however, that an entire meat diet supplies all physical needs; the meat tissue providing growth and repair and the fat supplying all of the carbonaceous elements. The fat, as pre-

viously stated, yields more heat than starches and sugars, and Nature provides this heat for climates where most warmth is required. It may be the natural reason why natives of warm climates have formed the habit of using vegetables and grains for their heat and energy rather than meat. It is also a natural reason why man, in temperate climates, eats more meat in winter than in summer.

An unperverted, natural instinct will always be found to have a sound physiological basis. For example,—if, by reason of some digestive disturbance, one has become emaciated, all of the fat having been consumed, and the cause of the disturbance is removed by an operation or otherwise, one is seized with an almost insatiable desire for fat, often eating large chunks of the fat of meat or large quantities of butter or cream at a meal. When obstructions are removed, Nature makes immediate effort to adjust her forces.

Those who object to eating meat should study carefully and know that the proper proportion of protein is supplied with each day's rations. The legumes—peas, beans, nuts, and grains—must be supplied with the vegetables. While the wheat kernel contains twelve per cent of protein, the

white flour does not contain as large a percentage and it will be noted by reference to Tables II and III, that the majority of fruits and vegetables contain little nitrogenous substance.

Unless the whole of the grain and the legumes form a goodly proportion of the diet the danger is in consuming too large a bulk of waste and too much starch in a purely vegetable diet. In a vegetarian diet, one is liable to eat too freely of cereals; as a result, the liver becomes clogged and torpid and the stomach and intestines are deranged and rendered incapable of full digestion and absorption. The clogged system refuses to assimilate more food.

It follows, therefore, that, unless one is a thorough student of dietetics, the mixed diet is by far the safest to follow. One can better run short of starch or fat in one day's rations than to be short of protein, because if the two to four ounces daily requirement is not provided the tissues are consumed and the blood is impoverished. It is a rare condition in which a reserve of glycogen and fat is not stored in the system. On the other hand an excess of nitrogenous foods calls for a very active circulation and plenty of oxygen in the system.

It has been held that the vegetarian has a clearer brain, and, if this be true, it may be due to the fact that he is not eating too much and thus his system is not overloaded.

Experience, however, does not prove that he has greater mental, physical, and moral power and efficiency. One's brain, in fasting, is at first clear and forceful, but the reason is unbalanced if the fast be too prolonged.

A complete diet may be selected without animal flesh, but including animal products of eggs, milk, cream, and butter, together with vegetables, fruits, cereals, and nuts, yet if the vegetable diet be selected the legumes, the whole of the grains, and nuts must be given their share in each day's rations.

MENUS

Before giving any menus, let me first of all impress upon the reader the importance of eating slowly, of good cheer, of light conversation during a meal, and of thoroughly masticating the food. Remember it is the food ASSIMILATED, *which nourishes.*

The following menus allow sufficient food for average conditions, when the vital organs are normal.

Fruit, as previously stated, contains a very small quantity of nutrition. It is more valuable for its diuretic effect; and to stimulate the appetite; for this reason it may well be eaten before a meal.

The citrous fruits tend to neutralize too strong acids of the blood, increasing its alkalinity. For this reason, also, they are best before a meal, particularly before breakfast; they have a more laxative and cleansing effect if eaten before the other food. The custom has been, however, to

eat fruits after dinner for dessert and they are so given on the following menus.

Sedentary Occupation

The following diet is for one who has attained full growth and who walks a few blocks a day. The diet may seem light, but where one is sitting indoor most of the time, and has little outdoor exercise, less waste protein is oxidized and less starch, fat and sugar are required for heat and energy. If too much carbonaceous food is consumed, one will store up too much and become too large. If more protein is consumed than is oxidized and eliminated one is liable to neuralgic or rheumatic difficulties.

Every person at sedentary employment should, without fail, exercise each day as suggested on pages 104 to 107.

In nearly all of the following menus coffee and tea have been omitted because, as before stated, they are not foods, but *stimulants* and the caffein and thein may overstimulate the nerves and the heart. They retard digestion. Some other warm drink should be substituted where there is digestive disturbance, or where the digestion is weak. They should never at any time be used strong. They are used for their pleasing flavor and where one has

difficulty in governing the desire for them, sufficient may be used to flavor the water.

The following is a suggestive diet for one who is not active:

BREAKFAST

Fruit,
Cereal or Toast Coffee,
Dry toast (two slices), or two muffins or two gems.

If one has taken brisk exercise, as suggested above, or is to take a brisk walk of a mile or two, a dish of oatmeal or some other cereal with cream and sugar, may be added.

LUNCH

Creamed soup, or pureé with crackers or dry toast.
Sandwich and fruit, or two slices of bread and butter with fruit.
Cup of custard or one piece of cake and milk or two cookies.
A glass of milk or buttermilk.
If pureé of peas or beans is used the sandwich may be omitted and one slice of bread is sufficient.

DINNER

Meat, gravy, potatoes or rice.
One vegetable, green peas, green beans, cauliflower, greens, corn. (Do not use dried baked beans or dried peas with lean meat.)
Salad or fruit.
Pudding, easily digested, such as bread, rice, tapioca, cornstarch or chocolate.

The Young Child

After one year, the child should be given solid food *very gradually* to develop his digestive functions as well as his teeth. The ferment, which

enables him to digest starches is beginning to form, and he needs some cereal. A piece of dry toast or a dry cracker will do. The year old child may also begin to drink cow's milk. One or two glasses a day may be given, until the child is at least thirteen or fourteen years old.

The child must build muscle, bone and sinew and more protein is required as soon as he begins to walk. Milk, eggs and cereals will furnish this. The heavier protein diet is best given at eighteen months to two years, in eggs, cooked soft. These soft cooked eggs are best when mixed with broken, dry toast or broken crackers, because if dry food is served with them, they will be better masticated, hence more saliva be mixed with them. The habit of thorough mastication should be cultivated at this period.

Oatmeal, thoroughly cooked, and shredded wheat, with cream and sugar, ripe fruit, bread and butter, milk, soft cooked eggs (poached, baked or boiled) constitute a rational diet.

If the child is hungry between meals, he should be fed at a regular period, midway between breakfast and luncheon and between luncheon and the evening meal. The food should be dry (toast or a dry cracker)

to require thorough and slow mastication.

Many object to ''piecing'' between meals, but if this piecing be done at hours as regular as his meal hour, and the food be dry and well masticated, it will readily digest and will not interfere with his meals. The growing child needs more frequent meals than the adult. His stomach is not so large, he is active in out door exercise, and eliminates waste freely. He also requires much heat and energy. The active child at out-door play uses almost as much energy as the laboring man.

The growing child craves sweets.

Candy should not be taken at any time during the day, because the digestive system needs rest. It is quickly converted into heat and is best eaten immediately following a meal. Sugar may be spread upon bread for the four o'clock lunch or a little candy may be eaten at this time. Two to three pieces of candy an inch square are sufficient.

The Developing, or the Adolescent Period

This period begins with a girl, usually near the thirteenth year, and with a boy about fourteen. There is no time in life when a mother needs to be so watchful of the diet. Growth is very rapid and

much easily digested protein is needed to build tissue, particularly to build the tissue of red corpuscles.

The red meats, eggs, spinach and all kinds of greens are important articles of diet at this time, because of the iron which they contain. They should be supplied freely, particularly for developing girls, or they may otherwise be inclined to anaemia, at this time. Butter and milk are valuable and *regular exercises with deep breathing are imperative.*

BREAKFAST.

Fruit.
Oatmeal or some other cereal, well cooked, with cream and sugar.
One egg, boiled, poached or baked (cooked soft), or chipped beef in cream gravy.
Cereal coffee, toast coffee or hot water with cream and sugar.
Buttered toast, shredded wheat biscuit or triscuit.

LUNCH

Cream soup, bean soup, or pureé with crackers or dry toast.
Bread and butter.
Fruit and cake, or rice pudding, or bread, tapioca, cocoanut or cereal pudding of any kind, or a cup of custard.

DINNER

An ample portion of meat, (preferably red meat).
Potatoes.
Vegetables, preferably spinach, or greens of some kinds, or beets boiled with the tops.
Graham bread.
Fruit with triscuit, graham bread toasted or graham wafers.
Candy. (small quantity)

A growing child is usually hungry upon returning from school, and it is well to take a little easily digested food regularly but not sufficient to destroy the appetite for the evening meal. An egg lemonade is easily digested and satisfying. If active and exercising freely, craving for sweets should be gratified, to a limited extent.

The Athlete

The young man, active in athletics, needs the same food as given for the adolescent, yet more in quantity. He needs to drink water before his training and at rest periods during the game. If he is too fat, he should train off the superfluous amount by exercise and by judiciously abstaining from much sugars, starches and fats. Diets for reductions must be governed by the condition of the kidneys and the digestive organs.

Deep breathing habits are imperative and he must be careful not to overtax lungs or heart.

The Laboring Man

The man engaged in muscular work requires plenty of food; he can digest foods which the professional or business man, or the man of sedentary habits, cannot. He will probably be able to drink coffee and tea without any dis-

turbance to nerves or to digestion. In his muscular work he liberates the waste freely and needs fats, starches and sugars to supply the heat and energy. This is especially true of men who work in the fresh air; the muscular action liberates waste and heat and the full breathing freely oxidizes the waste, putting it in condition to be excreted through lungs, skin, kidneys and intestines.

He should have more meat, eggs and nitrogenous foods, and he also needs more carbonaceous foods to supply heat and energy. Three hearty meals a day are necessary.

His muscular movements of the trunk keeps the circulation forceful and the vital organs strong so that his diet may be almost as heavy as that of the foot-ball player. Meat or eggs, two or even three times a day, with tea or coffee, and even *pie* may be eaten with impunity. He needs a good nourishing breakfast of bacon and eggs or meat, also potatoes, or a liberal allowance of bread and butter, corn bread, muffins, etc.

The Aged The term aged is not governed entirely by years. If one stops physical and mental activity, the vital forces

recede, muscles and vital organs become weak and inactive, the waste of the system is not fully relieved and such a man at fifty-five is physically and mentally older than the man who is in active business or is taking daily vigorous exercise, at seventy or eighty. The latter may follow the same diet which he follows at fifty, while the former should follow the diet of the old man who has stopped active work. It should be simple, easily digested and nutritious, and should be reduced in quantity.

BREAKFAST

Cereal, well cooked, with cream or sugar. Oatmeal is preferred because it is laxative.
One egg, boiled, poached or baked (soft).
One slice of toast.
Cereal coffee.

DINNER

Bouillon or soup.
Meat—small portion.
Potato (preferably baked).
Vegetable.
Cup custard, or bread, rice or cornmeal pudding with lemon cream sauce.

SUPPER

Soup.
Bread and butter.
Stewed fruit.
Tea.

An old person needs little meat. The food should be masticated to a pulp, Tea and coffee are best omitted, but if used to

tea, one small cup, prepared by turning boiling water on the leaves and served immediately, may be included. The tea should not be strong and, for reasons given on page 183, should never be allowed to steep.

If inclined to constipation, or if the kidneys are inactive, grapes or an apple, or some fruit may be eaten just before retiring.

MENUS FOR ABNORMAL CONDITIONS.

Where the body is not in normal condition, because elements are lacking in the blood, these elements must be supplied in larger proportions with the food, and the case is one for a food chemist, or for one who has made food conditions a study. When medical colleges broaden their curriculum, or physicians employ methods other than medicine and the knife, for correction of physical ailments, the relief will be with this profession. If they do not, professional schools for the education of the physical culturist and food specialists, for the correction of deranged conditions of the system, due to poor circulation and abnormal blood conditions, which have so long been controlled entirely through medicine, will spring up and replace much of the correction previously left entirely to the medical fraternity.

In case of an abnormal condition, the food must be regulated according to the case. This also applies to a diet where one carries an abnormal amount of fat.

In the early stage of various diseases, where toxins are hoarded in the system, it is often advisable to abstain from food for from one to three days, according to conditions. As previously stated, where the system is not properly eliminating the waste, it is wise to abstain from food, to take brisk exercise, breathe deeply and drink freely of water, until the waste is eliminated. A laxative is also desirable.

The above suggestions are for abnormal conditions. To *keep* the body in health, eat at regular periods.

It is the purpose here to give diets for chronic cases, which the average person attempts to regulate without a physician in regular attendance.

The foundation education in regard to foods, belongs in the public schools. How many lives are lost on account of the lack of knowledge of food values will never be known.

The system readily excretes an excess of vegetable products, and, as a rule, no acute difficulties result; however, such chronic difficulties, as Constipation, Torpid Liver

and Indigestion, frequently result from an excess of starch, over that consumed in energy. On account of the readiness to putrefaction of protein products, care should be taken not to consume these in too great proportion.

Broadly speaking, a diet largely of protein, which is digested in the stomach, rests the intestines, and a diet largely of carbohydrates, rests the stomach, because the gastric juice is not active in starch digestion. In case sufficient saliva is not swallowed with the food to digest the starches and sugars in the stomach they are passed into the intestines for digestion. In the absence of sufficient saliva, water with the food is desirable to dissolve the starches, that they may more readily pass the pylorus.

A study of the habitual taste for foods, in connection with the physical ailments of eighteen thousand women, shows that by the constituents in the blood, and the condition of the different organs of the digestive system, one can usually determine which food the individual has formed a habit of eating, because the blood will show a lack of the elements which that patient has denied himself on account of his likes and dislikes.

It is necessary to change the mental attitude toward certain foods before the system will assimilate them; thus *a taste for the foods which the body requires should be cultivated.*

Every mother, with growing children, should be a thorough student of the chemistry of food. If the child's bones do not grow to sufficient size and strength, care in the selection of foods, rich in proteins, lime, magnesium and phosphates, may correct it. Such a child should have meat, whole wheat bread and eggs.

Where the child stores up too much fat, care in the amount of exercise, and of oxygen consumed, as well as the regulation of diet, are of vital importance. If one is thin and undernourished, chemical analysis of the contents of stomach, intestines and kidneys should be made, the nerves be rested and proper food, exercise and breathing should accompany medical treatment, if medicine is needed.

Anaemia

Regular exercise and deep breathing are fully as important as the regulation of diet for the anaemic. In anaemia the red blood corpuscles are lacking, or there is not sufficient blood. The red corpuscles not being sufficient in num-

ber to carry the necessary quantity of oxygen to the tissues to oxidize the waste, the system becomes clogged with waste, which affects the nerves and brain cells. The patient is tired and disinclined to exercise, thus the decreased number of red corpuscles are not kept in forceful circulation and the carbonic acid gas is not freely thrown off by the lungs; this further aggravates the condition.

Pus formation, in abscesses, are frequent in anaemic cases.

There is little desire for food when the system is clogged, and there is little use in forcing food.

The red corpuscles are made in the red marrow of the bones and free action of the joints is desirable.

The initial work, therefore in the correction of anaemia, lies in brisk, every day exercise and deep breathing of fresh air. Such exercise should be intelligently directed to the joints and to the vital organs, particularly to the liver, that it may be kept in normal condition to break down the protein waste. The windows at night should admit of a good circulation of air through the sleeping room. These habits being established, the diet should consist of foods containing iron, such as red meat,

eggs and the green leaves of vegetables. Milk sipped slowly and a free use of butter are desirable.

It will usually be found that the anaemic individual has no taste for vegetables containing iron, or for meats rich in albuminoids, — or, that these foods have been denied because of their scarcity; therefore, the elements necessary for red blood corpuscles have been deficient.

The following is a suggestive diet:

BREAKFAST

Fruit, in plenty.
Two eggs, soft boiled, poached or baked.
Cereal coffee or cambric tea.
Toast, graham bread or graham or corn muffins.

MIDDLE OF THE FORENOON

Lemonade with spoonful of beef juice (not beef extract) or with a beaten egg.

LUNCH

Split pea or bean soup with dry toast.
Fruit and nut salad (no vinegar).
Fruit, fresh or stewed.
Cake.
Glass of milk.

MIDDLE OF AFTERNOON

Egg lemonade or eggnog.

DINNER

Bouillon.
Tenderloin steak or lamb chops.
Baked potato.
Spinach, beet or dandelion greens.
Custard, fruit gelatin, or cornstarch pudding, or rice with lemon cream sauce.
Glass milk.

If the patient still has no appetite, more exercise, deep breathing and abstinence from all food for a day or two are desirable. This will give the system a chance to clear itself of waste and when the waste is relieved through exercise and diet the desire for food will assert itself.

Indigestion and Dyspepsia

Indigestion or Dyspepsia is the broad term commonly applied to most chronic stomach and intestinal difficulties—due, not to structural disease, but to their being incapable of normally performing their functions in digesting ordinary foods. The term includes troubles arising from so many different causes that the cause must be determined and remedied before definite results can be attained through diet.

Most chronic cases are due to improper hygiene,—such as irregular meals; over eating; insufficient mastication; wrong choice of foods; or to a general run down condition, with a weakness of muscles of the stomach, due to insufficient blood supply; or to a weakened or over-strenuous condition of nerves controlling the stomach.

Indigestion is usually accompanied by constipation, or by irregular action of the intestines.

Plenty of fresh air, and exercise, directed definitely to muscles and nerves of the stomach, that it may be strengthened by a better blood supply, as well as exercises and deep breathing to build up the general health, should be systematically followed.

Easily digested food, well masticated, and regular meals served daintily, with following of above directions, will gradually regulate digestion.

Without doubt, the intelligent medical treatment of stomach difficulties in the future will be directed by a chemical analysis of the stomach contents. If the stomach is not secreting normal proportions of pepsin or hydrochloric acid, the deficiency can be regulated. The chemical analysis of the gastric secretions will alone determine what elements are lacking. As stated above, the permanent relief must lie in gaining a good circulation of blood through the entire body and through the stomach, that it may be strengthened and thus enabled to secrete these elements in proper proportions.

Many cases of stomach difficulty are due to the condition of the nerves.

Nervous Indigestion is due to the general nerve condition. In such cases the entire nervous system should be regulated through exercise, breathing, relaxation and a change of thought. Physicians usually recommend change of scene to direct change of thought.

The diet should be light and laxative and low in protein. Cream soup, bread and milk, crackers and milk, custards, egg lemonade, and gruels, furnish an easily digested list. No tea, coffee, very little meat and no fried food. Where the walls of the stomach are weak and distended, light food six times a day is preferable to a hearty meal, which distends the stomach walls.

Where a loss of weight occurs, it usually indicates a failure to *assimilate* a sufficient amount of food, rather than a failure to eat sufficient. A good circulation, particularly through the vital organs, deep full breathing of fresh air, and regular and complete rest periods, should be observed. Usually a dietitian, or a physician, is not called in chronic cases until the condition has prevailed for so long that other complications have set in and the

patient has lost much flesh. It takes months to pull the system down and it takes months of following of proper hygiene to build it up.

Gastritis or Catarrh of the Stomach involving an inflammation of the mucous lining of the stomach, is a most common phase of indigestion. In acute cases the physician is called at once. He can treat the case in its initial stages and bring about a much more rapid recovery.

Acute Gastritis is accompanied by nausea and vomiting and the patient should rest from all food and drink for two days. If the mouth is dry, water or ice may be given frequently and held in the mouth, but not swallowed.

After two days rest, begin the nourishment with water and a small portion of liquid food (not over two ounces) every two hours. Toast tea, made by pouring hot water over toast, oatmeal, or barley gruel (thoroughly strained so that no coarse matter may irritate the stomach), limewater and milk, and egg lemonade are easily digested foods to begin to eat. Increase the quantity the fourth day and lengthen the time between feedings to

three hours. Gradually increase the diet by semi-liquid food, soft boiled eggs, moistened toast, raw oysters, etc., slowly returning to the regular bill of fare.

Avoid, as you do so, any food difficult of digestion and any vegetable containing coarse fibre. Tea, coffee, pickles, and alcoholic drinks should be avoided.

Chronic Gastritis is accompanied with a thickening of the mucous lining of the stomach. It is usually caused by prolonged use of irritating foods and the regulation of the diet is of utmost importance. Alcohol is a common cause. The difficulty begins gradually and the relief must likewise be gradual.

The stomach needs water. If the drinking of water causes nausea it is well to wash it out with a stomach pump each morning before breakfast.

If not convenient to use the stomach pump the washing may be accomplished by drinking two glasses of water at least an hour before breakfast, followed by stomach exercises, to cause a regurgitation of the water through the stomach. This will be uncomfortable at first, with a very full feeling and one may begin by drinking one glass, followed by stomach exercises, grad-

ually taking another glass within a half hour of the first. This, with the exercises, will wash out the mucus. In many cases as much as a pint of slimy mucus collects in the stomach during the night. Where the stomach cleansing is impossible, in above manner, the stomach tube should be used.

Chronic gastritis, in any of its phases, is frequently accompanied by constipation, and the diet should be so selected as to be as laxative as possible, without irritating the lining of the stomach. The liquid diet assists the intestines, to a certain extent, particularly if the stomach be cleansed by the water in the morning, as indicated under Mucous Gastritis below.

Fruit in the morning and just before retiring aid the intestines. Two prunes chopped up with one fig or a bunch of grapes or an apple just before retiring assist the action of the intestines and the kidneys.

Almost all fruits contain acid, which increases peristalsis, and the resultant flow of gastric juice. Cooked pears, stewed or baked apples, prunes and dates are mild fruits which may be used if they agree with the patient. The juice of an orange upon first arising may be used, except in case

of a diminution, or absence, of hydrochloric acid.

Peptonized milk is an excellent food both for chronic and acute cases especially in severe cases. This is prepared by putting "pancreatin" a pancreatic ferment, (trypsin), into fresh milk. Preparations of "pancreatin" are sold in the drug stores. The peptonized milk does not form curds and readily passes through the stomach for digestion in the intestine. This may be given for a few days, followed by milk and limewater, barley and toast water, kumyss, oatmeal gruel, meat juices, scraped meat (raw, boiled or roasted), broths thickened with thoroughly cooked cereals, ice cream, egg lemonade, gelatins and whipped cream, custards, raw oysters.

After one week gradually assume the regular diet of easily digested foods. All cereals should be thoroughly cooked. The white meat of chicken is readily digested. As the solid food diet is assumed, regularity of food, in small amounts, and thorough mastication are important. If the patient imagines he is chewing it will help him to keep chewing until the food is reduced to a pulp.

Avoid meat with tough fibre, too fat meat (pork), sausage, lobster, salmon,

chicken salads, mayonnaise, cucumbers, pickles, cabbage, tea, coffee and alcohol.

Four or five light meals a day are preferable to three heavy meals.

The regulation of the flow of gastric juices is constitutional. The general circulation must be forceful, the habit of deep breathing and of regular periods of complete rest of body and mind established.

Since one with chronic gastritis is liable to have many idiosyncracies, he should not be urged to eat foods for which he has a dislike. The easily digested foods should be prepared in various ways and served in an appetizing, dainty manner.

There are four special phases of chronic gastritis, Mucous Gastritis, Hyperchlorhydria, Hypochlorhydria and Achlorhydria.

In *Mucous Gastritis* there is a profuse secretion of mucus into the stomach. In this case it is always well to wash out the stomach before introducing food, as suggested above.

The same general diet, suggested above for acute gastritis, should be followed.

Hyperchlorhydria. The condition known as Hyperchlorhydria shows a liberal excess of hydrochloric acid. The condition is common, and is brought on by worry, nervous excitement, eating when overtired,

irregularity of food, imperfect mastication and excessive use of alcohol. The diet should be a mixed one, in about normal proportions. If anything, it should incline more to proteins than to starches. The hydrochloric acid is necessary for the digestion of proteins. It reduces the protein to acid albumin, which is less irritating to the stomach. However the proteins are stimulating to the stomach and the protein proportion should not be carried to excess.

The juice of one-fourth of a lemon taken one half hour before the meal will decrease the secretion of hydrodiloric acid into the stomach.

Limewater and milk may constitute the diet for two days; alkaline, effervescing mineral water may be used and then the diet should follow the general principles for chronic gastritis. Avoid all irritating foods.

Hypochlorhydria is a diminution in the amount of hydrochloric acid. Physicians often administer hydrochloric acid about one half hour to an hour after the meal.

Many advocate a diet omitting protein, but since protein foods stimulate the flow of gastric juices, they should *not* be omitted, but used a little less freely.

Achlorhydria. Where there is an entire absence of hydrochloric acid, as in Achlorhydria, the stomach, of course, cannot digest proteins and this digestion must be done entirely by the trypsin of the pancreatic juice. The presence of liquified protein as beef juice in the stomach, however, acts as a stimulus to the gastric juice and is an agency in again starting its flow.

The foods should be liquid, so as to pass through the stomach without irritation. Clear milk must be excluded, because of the action of the rennin in coagulating the casein. This would irritate the stomach.

Peptonized milk, described on page 245 may be used as an article of diet,—also milk with limewater, gelatin, cream, olive oil, gruels, and any foods which would pass through the stomach in a liquid state. Any cereals must exclude the bran and must be masticated to a pulp, so that they may readily pass into the small intestine.

Dilation of the Stomach results from continued overeating, (especially when the nerves are weak), or eating when over tired. The muscular walls become so weak that they fail to contract. Peristalsis is likewise weak and the food, failing to digest promptly, ferments and forms gas. A

dilated stomach is larger and its weight and weakness cause it to prolapse.

In the prolapsed condition the pyloric, or lower orifice of the stomach, is often nearly closed, partly by reason of its position and partly by the weakened folds of the stomach walls. Because of this obstruction to the free emptying of the contents into the duodenum, it is imperative that the food be masticated to a pulp and thus mixed with saliva, that the salivary digestion of starches may be complete in the stomach; or, at least, that all foods be reduced to a liquid state in the stomach. A chunk of food could not easily pass through the pylorus. All liquid or semi-liquid food should be held in the mouth until it, also, is mixed with saliva. The stomach should not be overloaded with either food or water and for this reason six meals a day, of light feeding, is best.

A dilated stomach does not necessarily indicate that the digestive juices are not secreted in normal proportions and easily digested proteins need not be avoided. It is desirable to furnish the proteins in concentrated form, as in meats, so as to get the most nutrition with the least bulk. Milk may be used, with limewater, if sipped

slowly and held in the mouth until mixed with saliva.

Sugar should be used very sparingly, because it ferments readily and aggravates the distension. If it is evident that fermented products are in the stomach, it should be washed out with a stomach pump.

A tumor near the pylorus, or constriction of the pyloric orifice, will also cause dilation of the stomach.

Beef juice, any of the better grades of meats, well masticated and containing no gristle, limewater and milk, soft cooked eggs, and well cooked cereals should constitute the diet.

Avoid vegetables containing coarse fibre, fried foods, and bread baked on the same day.

Liquid with the meal should be avoided, on account of the tendency to overload the stomach.

Cold water, taken a swallow at a time at intervals during the day, has a tonic effect upon the relaxed muscles. It also incites the flow of gastric juice.

Ulcer of the Stomach. Where this condition is severe, accompanied with severe pains and vomiting of blood, the dietetic

treatment is to give the nourishment through the rectum for from five to ten days. Then follows a period of ten days milk diet, with bouillon, barley water, a beaten egg, and once a day, after the third day, strained oatmeal gruel.

Limewater is added to the milk to avoid the formation of leathery curds and to neutralize the acids of the stomach. The patient is given half a cup of milk every hour for three days, from 7 A. M. to 9 P. M. From the third to the tenth day increase the quantity to one cupful, then to a cup and a half and lengthen the periods between feedings to two hours. If the milk is brought to a boil before the limewater is added, it digests more readily.

After ten days, for the succeeding ten days the nourishment should be given every two hours and the diet varied by semi-liquid foods, such as gruels, toast water, soft boiled egg (once a day) beef juice, two softened crackers (once a day) gelatin, buttermilk and strained soups.

After twenty days the patient, if all is well, may very gradually resume a normal diet, beginning with baked potatoes, softened toast, lamb chops, a small piece of steak or white meat of chicken. It is imperative that all food, liquid or solid,

be thoroughly mixed with saliva and that solids be chewed to a pulp.

Liquids must not be swallowed either hot or cold, but about body temperature. Cold water may be taken into the mouth when more palatable than warm and held there until about body temperature before it is swallowed. All liquid should be sipped, not swallowed in gulps.

Cancer of the Stomach. Since the growth most often obstructs the pylorus, the stomach is usually dilated and the general directions for dilation of the stomach should be followed. If the food will not digest in the stomach, one must resort to rectal feeding. Where gastric digestion is near normal, the general principles of diet for ulceration of the stomach should be followed.

Intestinal Disorders

Most cases of intestinal difficulties may be traced to a clogged condition, either due to a weakness of the nerves and of the intestinal muscles, and a resultant weak peristalsis, which does not strongly move the mass along its course, or to a failure of the liver to discharge sufficient bile to lubricate the mass. If the waste is not promptly moved

through the intestines, irritation may result and the poisons from bacterial fermentations will be absorbed by the system.

Deranged stomach digestion also interferes with the digestion in the intestines.

Constipation. The causes of this difficulty are so varied that it can seldom be regulated by diet alone. It can be *helped.* A large number of cases of chronic constipation are due to the failure to respond to Nature's call at a regular time each day, thus establishing a regular habit at a certain hour. Many others are due to the weakness of the muscular walls of the intestines or to the nerves controlling them. In this event the intestinal peristalsis is weak. Still another cause is a failure of the liver to discharge sufficient bile into the intestines to lubricate the foeces. Many chronic cases are due to the pill and drug habit. Where one continues to take pills, the condition brings a result similar to the feeding of "predigested" food,—if the work is done for the organs they become lazy and rely upon artificial aid. *Every part of the body requires activity for strength.*

If the straight front corset cramps the intestines it may cause constipation by re-

straining their normal exercise during movements of the body in walking, etc. Every woman who wears the straight front corset should take exercises for the intestines morning and night.

The most natural relief for constipation is exercise,—particularly exercise directed to the muscles of the intestines and to the nerve centers controlling them.

Such foods as are laxative in effect, with the free use of water are helpful. Figs and raisins (due to their seeds), prunes, dates, grapes, apples, and rhubarb are laxative, due to their acids. These have best effect when eaten just before retiring.

Oatmeal, or any cereal containing the bran, is laxative,—such as bran bread or green corn.

As must be inferred from the above statement, the *cause* of the difficulty must first be reached.

Children should be trained to attend to Nature's call regularly *every* day. The best time is shortly after breakfast.

Enteritis. (Inflammation or Catarrh of the Intestines) is similar in its nature to Gastritis or Catarrh of the Stomach and is treated in a similar manner.

Acute Enteritis, as Acute Gastritis, is usually caused by a strong irritant,—either by some food which disagrees, or by a mass of undigested food. A fast of two or three days is the initial dietetic treatment. A free drinking of water not only soothes the irritated intestines but it cleanses the intestinal tract and assists the kidneys in eliminating elements of fermentation; if these are not eliminated, they will absorb into the blood.

Physicians usually give a course of calomel and castor oil to eliminate all intestinal contents.

After the fast, a liquid and semi-liquid diet is followed until inflammation is relieved. Milk, strained gruels, broths, strained soups, buttermilk, eggs (soft cooked or raw), beef juice, barley water, custards, gelatines, soft puddings, etc., are the foods most nourishing and causing least irritation.

All irritating foods as coarse vegetables, pickles, acid fruits and fruits with coarse seeds, candies, beer, wines and salads should be omitted.

Chronic Enteritis has the same general cause, as Acute Enteritis, though its onset is slow and it takes a correspondingly longer time to correct.

Dysentery, if acute, demands complete rest in bed. The diet in both Acute and Chronic cases must be confined to easily digested foods, such as peptonized milk (see page 244), boiled milk, pressed meat juice, and the white of egg, beaten and served with milk. Blackberry brandy, and tea made from wild cherry bark, tend to check the inflammation.

During convalescence, care must be taken not to over-feed. Begin a more liberal diet with a more liberal allowance of beef juice, gradually adding tender beef steak, roast beef, fish, white meat of chicken, eggs, custards, wine jelly, dry toast, blancmange, well boiled rice and other easily digested food. The beef and egg are particularly valuable, because of the anaemia occasioned by the loss of blood.

Rectal Feeding is sometimes necessary in cases of ulcer, cancer, or tumor, along the digestive tract. Since food is not absorbed in the large as readily as in the small intestine, the strength cannot be fully maintained through rectal feeding. In cases where the stomach is not able to digest the food, it is the best expedient,

however, until the functioning of the stomach is re-established.

The rectum should be prepared about an hour before the feeding by a full injection of water, to thoroughly cleanse the intestine. Place the patient on his side with the hips elevated. If for any reason he cannot lie on his side, let him lie on his back and elevate the foot of his bed. After the water cleansing, inject two or three ounces of water in which a small pinch of salt (6%) has been added and let it go high up into the rectum.

Two to three ounces four to five hours apart is the desirable quantity of rectal nutrition for an adult. The white of egg, beef juice, and milk, all peptonized, are the best foods. The pancreatic trypsin, sold in preparations of "pancreatin" is best. Unless milk is peptonized the casein will be difficult to absorb. The food should always be salted, as salt aids the absorption.

The white of egg should be diluted with four or five times its volume of water; to beef juice add an equal volume of water. The yolk of egg contains too much oil to absorb readily. Fats are not absorbed through the rectum. If egg and beef juice are used without milk, a little sugar may

be added. Milk contains sugar in proportion.

It is not advisable to inject wine as it interferes with absorption of other foods.

The nutriment should be forced eight to ten inches up into the rectum to insure absorption. This can be done by using a small injection point on a rubber tube and gently and patiently turning it as it is inserted. The tube may be oiled to prevent irritation.

Derangements of the Liver

The liver is not, in a strict sense, a digestive organ, but it is very dependent upon them, as all products of digestion must pass through it and the starches, sugars and proteins, after they enter the blood, undergo chemical changes here.

For a fuller understanding of the reasons for the following suggestions regarding diet for the liver, the writer would request a re-reading, at this point, of the chapter upon the "Work of the Liver" upon pages 81 to 92.

It will be recalled that the liver acts, not only upon proteins, sugars, and starches,—the nourishing foods, but it also stands guard over poisonous ferments, due to putrefactions absorbed from the intes-

tines, rendering them harmless; to a limited extent it also oxidizes the poisons of alcohol. The fats also pass through the liver.

Since all products of digestion must pass through this organ, it is easy to see how it may be overworked, for it is an undisputed fact that most people eat more food than is required to maintain the body in nitrogenous equilibrium and to supply the necessary heat and energy.

After the gorging of a heavy meal, the overloaded blood and liver express themselves in a sluggish brain and one feels mentally, as well as physically, logy, or overloaded.

Since both sugar, carbohydrates and protein undergo chemical changes in the liver, it is evident that a diet consisting of an excess of either, must overwork the liver, not only through the nutritive food elements absorbed, but through the toxic substances which must be absorbed,—due to the excessive amount of food not being digested as readily as a smaller amount. If the food remains in the intestines too long, it is attacked by the bacteria always present there, fermentation results and poisons are absorbed and carried to the liver, where they must be broken down and

rendered harmless, so as not to affect other parts of the system. If for any reason the liver is diseased, overloaded, or its action is sluggish, it will not promptly oxidize these toxins.

One of the most important corrective agencies for an inactive liver is exercise directed to this organ, to bring a free supply of blood, and deep breathing of fresh air. *It is apparent that the blood must carry its full quota of oxygen to assist in oxidizing both the nitrogenous waste and the poisons;* and it must be remembered that the liver must oxidize the waste from its own tissues, as well as from other parts of the system.

It is apparent, from the above, that the regulation of diet for an abnormal liver must be more in the *quantity* than in the *quality* of food and in the perfect digestion. It depends also upon the activity of the intestines, since the poisonous products of imperfectly digested and fermenting food, not being regularly eliminated, must be absorbed and carried to the liver. It is to free the intestines of the waste containing the toxins that physicians give calomel and other strong cathartics, to work off the toxins. These cathartics also work off foodstuffs from the intestines before they

are absorbed, so that the liver has more rest.

Torpid Liver or Billiousness. This condition is due to the sluggish action of this organ and a consequent failure to eliminate the bile through the bile ducts into the duodenum. It may be caused by inactivity and a resultant sluggish circulation of blood, to overwork of the liver, due to overeating, to breathing of impure air, or to insufficient breathing of pure air. It may also result from constipation and a resultant absorption of toxic matter as described above.

Many cases of billiousness are occasioned by obstruction of the opening of the bile ducts into the intestines, which is often occasioned by an excess of mucus in the duodenum. In such cases exercise for the intestines is clearly indicated.

In the bending, twisting and squirming movements which the infant in the cradle makes, the liver is regularly squeezed and relaxed. The same is true in the free movements of an active child at play. If during adult life these same free movements of bending and twisting the trunk were continued daily and correct habits of free breathing of pure air were established,

there would be little call for "liver tonics."

The elaboration of carbohydrates in the liver is an important part of its work and in case of inactive liver the sugars and starches should be limited, allowing that function to rest. Yet it is a mistake to allow a diet too rich in protein. The best method is to cut down the quantity of a mixed diet.

Two glasses of water an hour before breakfast followed by brisk exercise for the vital organs and deep breathing are important. The daily action of the bowels is imperative. In extreme cases a fast of two or three days, with a copious use of water. is recommended. Following this fast the diet should consist of easily digested foods, eliminating those containing starch and sugars in too great proportions, and it should be as limited as possible, consistent with the actual necessity for rebuilding and for energy.

Some authorities restrict fats in a diet for billiousness but the presence of fat in the duodenum stimulates the flow of pancreatic juice, which in turn stimulates the secretion of bile.

Lemon stimulates the action of the hepatic glands and thus tends to increase the liver activity.

There is a prevalent thought that eggs and milk cause sluggish liver action. There is no physiological reason for this if too much food is not eaten. One often loses sight of the fact that milk is a food as well as a beverage, and that when milk constitutes an appreciable part of the diet other foods should be limited accordingly.

The **DIET** may be selected from the following:*

Soups.—Light broths and vegetable soup with a little bread toasted in the oven.

Fish.—Raw oysters, fresh white fish.

Meats.—Mutton, lamb, chicken or game.

Farinaceous.—Whole wheat or graham bread and butter, toast buttered or dry, toasted crackers, cereals in small portions.

Vegetables.—Fresh vegetables, plain salads of watercress, lettuce, and celery.

Desserts.—Gelatins, fruits, cornstarch, ice cream, junket, simple puddings,—all with **very little sugar.**

Liquids.—Hot water, lemonade, orangeade, toast water, buttermilk, loppard milk and unfermented grape juice,—not too sweet.

AVOID.—All rich, highly seasoned foods, candies, cheese, pies, pastry, pan cakes, or any fried foods, salmon, herring, mackeral, bluefish, eels, dried fruits, nuts and liquors of all kinds.

Gall Stones

The diet for gall stones need have no reduction in protein nor carbohydrates, since the oxidation, or the chemical action upon sugars is not inter-

* Alida Frances Pattee; Practical Dietetics" Mt. Vernon, N. Y.

fered with. The presence of fat in the duodenum increases the flow of pancreatic juice which, in turn stimulates the flow of bile, so olive oil is often recommended in case of gall stones.

Diabetes is a serious disturbance of nutrition. It is known and tested by the appearance of sugar in the urine. However, the conclusion should not be drawn that one has diabetes if the urine test for a day shows sugar. This may be due to an excess of carbohydrates, particularly of sugar in the diet a day or two previous and all trace of it may disappear in a day. If continued tests for some period show an excess, nutritional disturbances are indicated.

The most usual form of diabetes is *diabetes mellitus*. It is supposed to be due to a disturbance in the secretions from the pancreas. Experiments have shown that the general process of putting the carbohydrates in condition to be absorbed into the blood is controlled by a secretion from the pancreas.

The difficulty which confronts the dietitian is to prescribe a diet without carbohydrates which will keep up the body weight and not disturb the nutritive equi-

librium. The diet must consist of protein and fat and one danger is in the tendency to acetic and other acids in the blood, which involves the nervous system. The patient has a craving for sugars and starches, but the system cannot make use of them, and the heat and energy must be supplied by fats. While, as a rule, the craving for certain foods is an indication that the system needs the elements contained in it,—this is true in the craving of the diabetes patient for carbohydrates,—yet the desire *must not* be gratified, because of the inability to digest them.

There is often a distaste for fat, but its use is imperative and in large quantities, because the weight and general vitality must be maintained. The effort of the physician is to get the system in condition to use carbohydrates.

Fats may be supplied in the yolk of egg, cream, butter, cheese, bacon, nuts, particularly pecans, butternuts, walnuts and Brazil nuts.

In beginning a diet, the change must not be too sudden. At least a week's time should be allowed for the elimination of all sugar and starch. Begin by eliminating sugars and next bread and potatoes.

Van Noorden gives the following diet, free from carbohydrates, which has been in general use in Europe and America.

BREAKFAST.

Tea or coffee, 6 ounces.
Lean meat (beefsteak, mutton chop, or ham), 4 ounces.
Eggs one or two.

LUNCH.

Cold roast beef, 6 ounces.
Celery, or cucumbers, or tomatoes with salad dressing.
Coffee, without milk or sugar, 2 ounces.
Whisky, drams, diluted with 13 ounces of water.

DINNER.

Bouillon, 6 ounces.
Roast beef, 7½ ounces.
Green salad, 2 ounces.
Vinegar, 2½ drams.
Butter, 2½ drams.
Olive oil, 5 drams, or spinach with mayonnaise, large portion.
Whisky, 5 drams, diluted with 13 ounces water.

SUPPER, 9 P. M.

Two eggs, raw or cooked.

Van Noorden includes alcohol, in whisky, in his diet and most physicians follow the theory that whisky or brandy aids in the digestion and absorption of fats; the need is recognized since fats must be supplied in so large quantities, yet the sweet wines and beers contain sugar while the sour wines contain acids, which disturb digestion.

There is a grave question in regard to the advisability of including alcohol in the diet of a young person afflicted with diabetes and the greater activity of the young patient will insure more perfect digestion, so that the physician may not consider alcohol necessary.

Dr. Hall gives the following as a reasonable diet for a diabetic case, after the first week or two, allowing potatoes.

BREAKFAST.

Tea or coffee, 6 ounces.
Cream, 2 ounces.
Meat, (beefsteak, mutton chops, or ham), 4 ounces.
Bread and butter, 2 slices.
Baked potato, with butter.

LUNCH.

Cold roast beef or cold boiled ham, 6 ounces.
Bread and butter, two slices.
Salad with mayonnaise dressing, egg garniture.
Tea or coffee with cream.

4 P. M.

Egg lemonade or egg orangeade.

DINNER.

Clear soup of any kind.
Roast beef or mutton, or pork.
Potatoes, baked or boiled.
Olives, celery, or radishes.
Side dish of green vegetables.
Bread and butter.
Dessert, milk-egg custard, sweetened with saccharin.

After a week on either of the above diets, in mild cases, sugar will disappear from

the urine. In extreme cases, it may be necessary to follow this strict regime for two weeks. When the patient begins to eat a little starch, potatoes and bread are re-instated first. Sugar is kept out of the diet, except the little in fruit and vegetables, until the urine shows no trace of it.

The following is a list of foods allowable:

Fresh meat, fish, oysters, clams, lobster, turtle, meat extracts, fats of all kinds, eggs, such fresh vegetables as peas, beans, lentils, lettuce, celery, asparagus, cabbage, pickles, clear soups (all kinds), cheese (all kinds), coffee, tea (without sugar), cream, butter, fruit, acid drinks and carbonated waters.

Derangements of the Kidneys

In the dietetic treatment of any diseased organ, the object must be to give that organ as much rest as consistent with keeping up the general nutrition of the system. The stomach and intestines are so closely allied that, where one is affected, the other is liable to affection also, and the dietetic treatment is regulated accordingly. Yet generally speaking, in stomach disorders the quantity of protein is limited; in intestinal disorders the starches, sugar and fats are

limited. Since the office of the kidneys is to pass from the system the soluble salts and the nitrogenous waste, which dissolve in water, the work of the kidneys in most conditions is aided by a copious drinking of water. Since uric acid is stimulated by the kidneys, the proteins should be restricted in the diet, particularly those formed from the glands of animals,—as liver, sweetbreads, kidneys, also brains. Potatoes, green vegetables, stone fruits and cranberries aggravate an acute condition.

Acute Nephritis. In case of inflammation of the kidneys the excretions are interrupted. In this event the quantity of water should be limited to three to four glasses a day. In the event that the kidneys will not excrete the water, the pores of the skin must be kept freely open by sweat baths to assist in the elimination of waste.

Dr. Hall recommends a milk and cream diet of from three to seven pints a day, for a few days, according to the case,—two parts of milk to one of cream. If the urine is scanty, he reduces it to one and one half pints a day, taken in four or five installments. After the three to seven days of

milk diet he gradually introduces starches and fats.

Brights Disease. This term covers forms of diseases of the kidneys, associated with albumin in the urine.

Where for any reason the kidneys have difficulty in discharging the nitrogenous waste of the system, the work of the dietician must be to eliminate protein from the diet as closely as may be consistent with the body necessities. Besides restricting the amount of nitrogenous foods, the kidneys must be assisted in eliminating the nitrogenous waste, and the products of the inflammation, by a copious drinking of water. Hot water and hot diluent drinks are best, such as toast water, barley water, cream of tartar, lemon and acid drinks. In acute cases the patient is put on a milk diet of from two to three pints of milk a day, given one-half pint every three or four hours, diluted with one-third as much hot water. If the case be a prolonged one, broths may be included.

Even in cases which are chronic and not acute, it is well to follow a milk diet for a number of weeks. The quantity of milk, for an exclusive milk diet, must depend upon the age and size of the patient as well

as upon his ability to exercise. If he is confined to his room, from five to seven pints of milk a day are sufficient. If he is taking a great deal of exercise, he may take from eighteen to twenty glasses of milk a day. If he loses weight on the milk diet, bread and rice may be added.

It is unwise to begin a milk diet at once, by feeding from eighteen to twenty glasses of milk a day, but this amount may be approximated within a week's time and the change in diet should be begun by cutting down all meats and legumes and gradually eliminating starches. In changing from a milk diet to a diet including more hearty foods, the transition should be gradual.

A. F. Pattee gives the following diet for Brights Disease.

DIET: **Soup.**—Vegetable or fish soup, broths with rice or barley.

Fish.—Raw oysters or clams, fresh fish broiled or boiled.

Meats.—Eat sparingly, chicken, game, fat bacon, fat ham.

Farinaceous.—Stale bread, whole wheat bread, toast, milk toast, biscuits, macaroni, rice, cereals of all kinds.

Vegetables.—Onion, cauliflower, mashed potatoes, mushrooms, lettuce, watercress, spinach, celery, cabbage.

Desserts.—Ripe raw fruits, stewed fruits, rice tapioca, bread and milk puddings, junkets, cocoa.

Liquids.—Toast water, weak tea, pure water, peptonised milk, malted milk, fresh buttermilk, milk with hot water, equal parts, whey, unfermented grape juice.

AVOID.—Fried fish, corned beef, hashes, stews, pork, veal, heavy bread, batter cakes, lamb, mutton, beef, gravies, beans, peas, malt or spirituous liquors, tobacco, coffee, ice cream, cake, pastry.

Nervous Disorders

The condition of the nerves depends upon the general condition of the system and upon general nutrition. There is no one food or set of foods which directly affect any nervous trouble, unless this trouble be localized by disturbance in some particular organ. Then the effort must be to correct the difficulty in that organ.

There is no disturbance in any part of the body requiring less medicine than a disturbance in the nerves. The correction must come through general hygienic treatment. Regular exercise, alternated with regular rest periods, the formation of the habit of complete nerve relaxation, the general regulation of an easily digested, nutritious diet, with deep breathing exercises, are the best remedies.

In many cases of nerve debility the nerves seem to be stronger in the latter part of the day. Where this is the case the hearty meal should be eaten at this time.

Neurasthenia. In cases of Neurasthenia, or "Tired Nerves," all vital organs are more or less affected, because the nerves do not properly direct digestion, absorption, assimilation or elimination and, for this reason, the diet should be light and of easily digested foods. *A free, correct breathing of fresh air, day and night, is imperative.* It is important also to thoroughly masticate all food and drink freely of water. A change of thought, induced by a change of scene or companions, is helpful.

Gout

This difficulty is usually the result of high living. It most often attacks people past middle age, who have indulged in rich pastries, puddings, meat three times a day, or who have frequently indulged in alcohol.

Being supposedly caused by an excess of uric acid and other waste deposited in the joints, resulting from too much protein and an insufficient elimination of the waste of the system, the dietetic treatment must be a low protein diet. Alcohol is absolutely prohibited and the quantity of carbohydrates and fats must be cut down as well as the protein.

In *acute cases* a diet of bread and milk, or toast and milk, with light vegetable broths should be followed for one to three days.

In *chronic cases* the diet may consist of the following:*

Soups.—Vegetable broths.

Fish.—Fresh fish, shell fish, raw oysters.

Meats.—It is better to omit all meats. If meat is eaten at all, it should be confined to game, chicken and fat bacon.

Farinaceous.—Cereals, crackers, dry toast, milk toast, macaroni, graham or whole wheat bread, rye bread, oatmeal and any of the breakfast foods.

Nuts.—With salt.

Vegetables. — Celery, lettuce, watercress, all greens, with vinegar, string beans, green peas, potatoes, carrots and beets.

Fruits.—All fruits, stewed or fresh. Unpeeled apples are especially recommended. (Greens, with vinegar and unpeeled apples increase the action of the kidneys.

Desserts.—Plain puddings, junket, rice, stewed or fresh fruits.

Liquids.—Pure water, toast water, barley water, butter milk, malted milk, milk.

Eat eggs sparingly and in severe cases, not at all.

AVOID.—Alcohol, coffee, tobacco, dried fruits, nuts, cheese, candies, pastries, pies, spices, rich puddings, fried foods, vinegar, pickles, lemons, rhubarb, mushrooms, asparagus, sweet potatoes, tomatoes, gravies, patties, rich soups, lobster, salmon. crabs, mackeral, eel, veal, pork, goose, duck, turkey, salted, dried, potted or preserved fish or meat, (except bacon).

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* A. F. Pattee; "Practical Diatetics," A. F. Pattee, Publisher, Mt. Vernon, N. Y.

Rheumatism. Since the medical profession is unable to determine just what rheumatism is, it is difficult to prescribe a diet. The theory so long believed that it is an excess of uric acid in the system is no longer held by most of the advanced physicians. Some authorities hold that it is a nerve difficulty; others that it is an excess of lactic acid. Some authorities put one on an entire meat diet, in case of rheumatism, and others entirely exclude meat. Uric acid may accompany the disease.

Assuming that it is due to the failure of the system to promptly eliminate its waste, whether this failure to eliminate be through a weakened condition of the nerves, and the consequent failure to properly direct the body activities, the correction of the difficulty must lie in building up the general vitality and in aiding the system in its elimination. Hot sweat baths, a free use of water and a free use of fruits, particularly the citrous fruits, such as lemons, oranges, limes, etc., are desirable, because they increase the alkalinity of the blood. The acid unites with other acids of the body acting as a re-agent. Often when the acids of the stomach are strong, sodium carbonate (baking soda) produces an alkaline reaction.

The diet should be cut down in quantity. Meat may be eliminated if an excess of uric acid exists and the above suggestions under the diet for *Gout* be followed.

Fruit juices should be used freely because of their alkaline reaction and because of their diuretic effect. Lemonade, orangeade and all fresh fruits and vegetables are diuretic.

Regular exercises, until the body is thoroughly heated, deep breathing of pure air day and night and a copious drinking of water are necessary.

Uremia or Uremic Poisoning

Interference in the action of the kidneys is apt to result in a retention within the system of the elements, which the kidneys, in normal condition, eliminate from the system, such as urea, uric acid, urates, sulphuric acid, sulphates, sodium phosphate, xanthin bodies and conjugated sulphates. These substances are not thrown off by the skin, or by the lungs, and must all be eliminated through the kidneys. They are the result of the oxidation and the breaking down of the proteins of the body. If the kidneys do not throw these off, the result is Uremic Poisoning, and the dietetic treatment must be to cause a free action of the kidneys by

the use of diuretics. Of these the citrous fruits, (lemons, oranges, limes, etc.,) are the best; they neutralize acids and produce an alkalinity of the blood. They should be used freely.

Meats, eggs and legumes should be eliminated from the diet. A free drinking of water, milk with limewater, cereals, buttermilk, kumyss, barley water, toast water, lemonade, orangeade, vegetables and fruit should constitute the diet. Exercise and free breathing of fresh air are imperative. All food should be thoroughly masticated.

Excess of Uric Acid

An excess of uric acid may not always cause uremic poisoning, but it indicates an excess of protein in the system above the amount eliminated by the kidneys and the skin. This excess is often the cause of chronic ailments, such as bronchitis, asthma, hay-fever, severe nerve depression, gout, rheumatism, neuralgia, tonsilitis, grippe, influenza, colds, etc.

The natural relief is to control the diet, supplying less protein and to increase the elimination through a free action of the kidneys, of the pores of the skin, and of the lungs. Systematic exercise, deep breathing, a copious drinking of water and

fresh air day and night, are the best reliefs.

One may either eliminate the proteins from the diet, or may cut down the entire quantity of food, and, by exercise, breathing, a freedom of the pores of the skin and a free drinking of water, so as to create an activity of the kidneys, may continuously eliminate more uric acid than is consumed in the food.

The regulation of the quantity of the food, rather than the cutting down of the proteins and the feeding of a larger proportion of starches, is the course pursued where one is inclined to an excess of uric acid and still has an excess of fat.

In case of an excess of uric acid in thin persons, such proteins food as meat and eggs may be eliminated and the diet consist almost wholly of carbohydrates and fats.

The diet is the same as that given above for *Gout*.

Obesity

All diets for obesity must be prescribed for the individual condition. A large number of the obese are afflicted with rheumatism, sluggish livers, sluggish action of the intestines and weak

nerves, and the diet must be governed accordingly.*

The regulation of food for reduction of flesh must, also, be governed by age, sex, by the manner of breathing and by the amount of daily exercise.

Exercise, breathing and diet are the scientific means of reduction, the food must be regulated in accordance with the quantity of carbohydrates and fats daily consumed in heat and energy.

Leanness No definite diet can be given for flesh building, because a lack of sufficient fat to round out the figure is due to faulty digestion or assimilation and the cause must first be eliminated.

It may be that the strength of the muscles and nerves of stomach, liver and intestines must first be built up by exercises and deep breathing, and it may be that the habit of nerve relaxation must be established. Where one's nerves are tense much nourishment is consumed in nervous energy and the nerves to digestive organs and muscles being tense, interfere with digestion and assimilation.

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* Editor's Note: The causes and relief of Obesity are fully discussed in my book of this series "Poise, Obesity and Leanness, their Causes and Relief."

It is apparent that the cause must first be corrected, because to overload the digestive organs with sugars, starches and fats, further weakens them.

APPENDIX

MEASURES AND WEIGHTS.

A few tables of measures may be helpful here because accurate measurements are necessary to insure success in the preparation of any article of food.

All dry ingredients, such as flour, meal, powdered sugar, etc., should be sifted before measuring.

The standard measuring cup contains one-half pint and is divided into fourths and thirds.

To measure a cupful or spoonful of dry ingredients, fill the cup or spoon and then level off with the back of a case-knife.

In measures of weight the gram is the unit.

A "heaping cupful" is a level cup with two tablespoonsful added.

A "scant cupful" is a level cup with two tablespoonsful taken out.

A "salt spoon" is one-fourth of a level teaspoon.

To measure butter, lard and other solid foods, pack solidly in spoon or cup and measure level with a knife.

TABLE OF MEASURES AND WEIGHTS*

4 saltspoons	**= 1 teaspoon, tsp.**
3 teaspoons	**= 1 tablespoon, tbsp.**
4 tablespoons	**=¼ cup or ½ gill.**
16 tablespoons (dry ingredients)	**= 1 cup, c.**
12 tablespoons (liquid)	**= 1 cup.**
2 gills	**= 1 cup.**
2 cups	**= 1 pint.**
2 pints	**= 1 quart.**
4 quarts	**= 1 gallon.**
2 tablespoons butter	**= 1 ounce.**

1 tablespoon melted butter	= 1 ounce.
4 tablespoons flour	= 1 ounce.
2 tablespoons granulated sugar	= 1 ounce.
2 tablespoons liquid	= 1 ounce.
2 tablespoons powdered lime	= 1 ounce.
1 cup of stale bread crumbs	= 2 ounces.
1 square Baker's unsweetened chocolate	= 1 ounce.
Juice of one lemon=(about) 3 tablespoons	
5 tablespoons liquid	= 1 wineglassful.
4 cups of sifted flour	= 1 pound
2 cups of butter (packed solid)	= 1 pound
2 cups of finely chopped meat (packed solidly)	= 1 pound
2 cups of granulated sugar	= 1 pound
2⅖ cups of powdered sugar	= 1 pound
2⅔ cups brown sugar	= 1 pound
2⅔ cups oatmeal	= 1 pound
4¾ cups rolled oats	= 1 pound
9 to 10 eggs	= 1 pound
1 cup of rice	= ½ pound.

APOTHECARIES WEIGHTS*

20 grains	= 1 scruple, ℈
3 scruples	= 1 drachm, ʒ
8 drachms (or 480 grains)	= 1 ounce, ℥
12 ounces	= 1 pound, lb.

APOTHECARIES MEASURES*

60 minims (M)	= 1 fluid drachm, f ʒ
8 fluid drachms	= 1 fluid ounce, f ℥
16 fluid ounces	= 1 pint, 0 or pt.
2 pints	= 1 quart, qt.
4 quarts	= 1 gallon, gal.

APPROXIMATE MEASURES*

One teaspoonful	equals about 1 fluid drachm.
One dessertspoonful	equals about 2 fluid drachms.
One tablespoonful	equals about 4 fluid drachms.
One wineglassful	equals about 2 ounces.
One cup (one-half pint)	equals about 8 ounces.

METRIC MEASURES OF WEIGHT*

In measures of weight the gram is the unit.

1 gram	**1.0**	**gm.**
1 decigram	**0.1**	**gm.**
1 centigram	**0.01**	**gm.**
1 milligram	**0.001**	**gm.**

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* Practical Diatetics, Alida Frances Pattee, Publisher, Mt. Vernon, N. Y.

Classification of Diets.

The purpose is not to give below such receipts as are found in ordinary cook books, but simply to suggest foods useful for invalids, for semi-invalids, or for chronic, abnormal conditions of digestive organs.

BEVERAGES.

Beverages are primarily to relieve thirst; they may also contain food elements; they may be used for their effect in heat and cold; for their flavor which helps to increase the appetite; or for their stimulating properties.

WATER. Pure and carbonated; mineral waters contain iron, sulphur, lithium, etc.

Hot drinks should be served at a temperature of from 122 to 140 degrees F. When water is used as a hot drink it should be freshly drawn, brought to a boil and used at once. This sterilizes and develops a better flavor.

Cold water should be thoroughly cooled, but not iced, unless ice water is sipped very slowly and held in the mouth until the chill is off. Water is best cooled by placing the receptacle on ice rather than by putting ice in the water.

FRUIT JUICES. Under fruit juices are
Grape juice, apple juice,
Currant juice, pineapple juice,
Orangeade and lemonade.

They are especially grateful to fever patients and are often used to stimulate the appetite. They are particularly valuable for the acids which they contain, which stimulate the action of the kidneys and the peristaltic action of the digestive tract; they also increase the alkalinity of the blood.

Apples contain malic acid, lemons citric acid and grapes tartaric acid. The ferment in the ripe pineapple juice aids in the digestion of proteins.*

Lemonade. Wash and wipe a lemon. Cut a slice from the middle into two pieces to be used in the garnish before serving; then squeeze the juice of the rest of the lemon into a bowl, keeping back the seeds. Add sugar and boiling water; cover and put on ice to cool; strain and pour into a glass.

Fruit Lemonade. To change and vary the flavor, fresh fruit of all kinds may be added to strong lemonade, using boiling water as directed above.

Egg Lemonade. Beat an egg thoroughly, add 2 tablespoonsful of sugar, 2 tablespoonsful of lemon juice and gradually pour in one cup of cold water. Stir until smooth and well mixed. Serve thoroughly cold. This drink is very easily digested, the lemon having partly digested the egg; 2 tablespoonsful of sherry or port may be added.

Bran Lemonade. Mix ¼ cup of wheat bran with 2 cups of cold water. Allow this to stand over night and in the morning add the juice of a lemon.

Pineapple Lemonade. Mix ½ cup of grated pineapple with the juice of 1 lemon and 2 tablespoonsful of sugar; add ½ cup of boiling water, put on ice until cool, then add 1 cup of ice cold water. Strain and serve.

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* The following receipts for fruit beverages are adapted from Practical Diatetics by Alida Frances Pattee, Publisher, Mt. Vernon, N. Y.

Grape Lemonade. To one cup of lemonade, made as directed above, rather sweet, add ½ cup of grape juice.

Orangeade is prepared as lemonade. The juice of one sour orange to 2 tablespoonsful of sugar and ½ cup of boiling water is about the right proportion.

Mixed Fruit Drink. Mix ¼ cup of grated pineapple, the juice of ½ a lemon, the juice of ½ an orange, 1 cup of boiling water and sugar to taste. Put on the ice until cool. Strain and add more cold water and sugar according to taste.

Pineapple Juice. Pour ½ cup of pineapple juice over crushed ice and serve in a dainty glass. This is especially helpful in cases of weak digestion and in some throat troubles—as stated above, the pineapple aids protein digestion.

Lemon Whey. Heat one cup of milk in a small sauce pan, over hot water, or in a double boiler. Add two tablespoonsful of lemon juice; cook without stirring until the whey separates. Strain through cheese cloth and add two teaspoons of sugar. Serve hot or cold. Garnish with small pieces of lemon.

Wine Whey may be made in the same way, using ¼ cup of sherry wine to 1 cup of hot milk.

Grape Juice, Apple Juice and Currant Juice are tonics and make a dainty variety for the sick room. They should be used according to their strength. usually about 1/3 of juice to 2/3 water. They should be kept cold and tightly corked until ready to serve.

Grape Lithia. Add 4 ounces of Lithia water to 1 ounce of grape juice and two teaspoons of sugar.

Grape Nectar. Boil together 1 pound of sugar and ½ pint of water until it begins to thread. Remove from the fire and when cool add the juice of 6 lemons and one quart of grape juice. Let stand over night. Serve with ice water, Apollinaris, or plain soda water.

Tea Punch. Pour boiling lemonade, sweetened to taste, over tea leaves. Allow the liquid to stand until cool. Then strain and serve with shaved ice and slices of lemon. This makes a delicious cooling drink for hot weather.

LIQUID FOODS.

Under this heading such liquids are given as are actual foods.

MILK. Milk is a complete food and a perfect food for infants, but not a perfect food for adults. It may be used as

Whole or skimmed;

Petonized; boiled;

Sterilized, pasteurized;

Milk with lime water, Vichy or Appollinaris;

With equal parts of farinaceous liquids;

Albuminized milk with white of egg;

Milk with egg yolk, flavored with vanilla, cinnamon or nutmeg;

Milk flavored with coffee, cocoa, or meat broth;

Milk punch; milk lemonade;

Koumiss; kefir or whey, with lemon juice, as above.

EGG PREPARATIONS. These consist of

Albumin water (diluted white of egg), flavored with fruit juice;

Egg lemonade; egg orangeade;

Egg with meat broth;

Egg with coffee and milk;

Chocolate eggnogg.

Often the white of egg, dissolved in water or milk, is given when the yolk cannot be digested, because of the amount of fat which the yolk contains.

Where one is inclined to billiousness, the egg is better digested if beaten in wine.

The albuminous or egg drinks are best prepared cold.

Egg-nog. To make egg-nog, separate the white and the yolk, beat the yolk with ¾ of a tablespoonful of sugar and a speck of salt until creamy. Add ¾ of a cup of milk and 1 tablespoonful of brandy. Beat the white until foamy, add to the above mixture and serve immediately. A little nutmeg may be substituted for the brandy. The eggs and milk should be chilled before using. Egg-nog is very nutritious.

Egg Broth. Beat the yolk of 1 egg, add 1 tablespoonful of sugar and a speck of salt. Add 1 cup of hot milk and pour it on gradually. Flavor with nutmeg.

Dried and rolled bread crumbs may be added, or beef, mutton or chicken broth may be used in place of the milk, and the sugar may be omitted. The whole egg may be used if desired.

This is very delicious made with beef broth, instead of hot milk. Pineapple juice or coffee may be used.

Coffee Egg-nog. 1 egg, 1¼ teaspoons of sugar, ½ scant cup of milk or cream, ½ scant cup of coffee.

Egg Malted Milk. Mix 1 tablespoonful of Horlick's Malted Milk with 1 tablespoonful of crushed fruit and 1 egg; beat for five minutes. Strain and add 20 drops of acid phosphate, 1 tablespoonful of crushed ice and ¾ cup of ice water. A grating of nutmeg may be used for flavor.

Grape Yolk. Separate the white and the yolk of an egg, beat the yolk, add the sugar and let the yolk and sugar stand while the white of the egg is thoroughly whipped. Add two tablespoonsful of

grape juice to the yolk and pour this on to the beaten white, blending carefully. Have all ingredients chilled before blending and serve cold.

Albuminized Milk. Beat ½ cup of milk and the white of one egg with a few grains of salt. Put into a fruit jar, shake thoroughly until blended. Strain into a glass and serve cold.

Albumin Water. Albumin water is used chiefly for infants in cases of acute stomach and intestinal disorders, in which some nutritious and easily assimilated food is needed. The white of 1 egg is dissolved in a pint of water, which has been boiled and cooled.

Albuminized Grape Juice. Put two tablespoonsful of grape juice into a dainty glass with pure chopped ice. Beat the white of one egg, turn into the glass, sprinkle a little sugar over the top and serve.

FARINACEOUS BEVERAGES. These are all made by slowly adding cereals, such as barley, rice, oatmeal, etc., to a large quantity of boiling water and cooking from two to three hours and then straining off the liquid and seasoning to taste. They are particularly valuable when only a small amount of nutriment can be assimilated. Since the chief ingredient is starch, long cooking is necessary to make soluble the starch globules and to change the starch into dextrin, so that it can be more readily digested. Since these drinks are given only in case of weak digestion, it is important that they be taken slowly and held in the mouth until they are thoroughly mixed with the saliva.

Barley Water. (Infant feeding). Mix 1 teaspoonful of barley flour with two tablespoonsful of cold water, until it is a smooth paste. Put in the top of a double boiler and add gradually one pint of boiling water. Boil over direct heat five minutes, stirring constantly; then put into a double boiler, over boiling water, and cook fifteen minutes longer. This is used as a diluent with normal infants and to check diarrhoea.

For children or adults use ½ teaspoonful of barley or rice flour, 1 cup of boiling water and ¼ teaspoonful of salt. Cream or milk and salt may be added for adults, or, lemon juice and sugar, according to the condition.

Barley water is an astringent and used to check the bowels when they are too laxative.

Rice Water. Wash two tablespoonsful of rice, add 3 cups of cold water and soak thirty minutes. Then heat gradually and cook one hour until the rice is tender. Strain through muslin, re-heat and dilute with boiling water or hot milk to the consistency desired. Season with salt; sugar may be added if desired and cinnamon, if allowed, may be cooked with it to assist in reducing a laxative condition. 1 teaspoonful of stoned raisins may be added to the rice, before boiling, if there is no bowel trouble.

Oatmeal Water. Mix 1 tablespoonful of oatmeal with 1 tablespoonful of cold water. Add a speck of salt and stir into it a quart of boiling water. Boil for three hours, replenishing the water as it boils away. Strain through a fine sieve or cheese cloth, season and serve cold. Sufficient water should be added to keep the drink almost as thin as water.

Toast Water. Toast thin slices of stale bread in the oven; break up into crumbs; add 1 cup of boiling water and let it stand for an hour. Rub through a fine strainer, season with a little salt. Milk, or cream and sugar may be added if desirable. This is valuable in cases of fever or extreme nausea.

Crust Coffee. Dry crusts of brown bread in the oven until they are hard and crisp. Pound or roll them and pour boiling water over. Let soak for fifteen minutes, then strain carefully through a fine sieve.

Meat Juice. Meat juice may be prepared in three ways:

(1) Broil quickly, or even scorch, a small piece of beef. Squeeze out the juice with a lemon squeezer, previously dipped in boiling water. Catch the juice in a hot cup. Season and serve. If desirable to heat it further, do so by placing the cup in hot water.

(2) Broil quickly and put the small piece into a glass jar. Set the covered jar in a pan of cold water. Heat gradually for an hour, never allowing the water to come to a boil. Strain and press out the clear, red juice, season and serve. One pound of beef yields eight tablespoonsful of juice.

(3) Grind raw beef in a meat grinder; place in a jar with a light cover and add one gill of cold water to a pound of beef. Stand it on ice over night, strain and squeeze through a bag. Season and serve.

Meat Tea. Meat tea is made in the proportion of a pound of meat to a pint of water. Grind the meat in the meat grinder, place in a jar and cover with cold water. Set the jar in an open kettle of water and cook for two hours or more, not allowing the water to boil. Strain, squeeze through a bag, skim off the fat and season.

Meat Broth. Meat broth is made from meat and bone, with and without vegetables. The proportion is a quart of water to a pound of meat. Cut the meat into small pieces, add the cold water and simmer until the quantity is reduced one-half. Strain, skim and season with salt. Chicken, veal, mutton and beef may be used in this way. They may be seasoned with onions, celery, bay-leaves, cloves, carrots, parsnips, rice, barley, tapioca; stale bread crumbs may be added.

Soups. Clear soups are made by cooking raw meat or vegetables, or both together, slowly, for a long time, straining and using the liquid. The flavor may be changed by browning the meat or vegetables in butter before adding the water.

Cream Soups are made in the proportion of one quart of vegetables, (such as corn, peas, beans, tomatoes, celery or asparagus) to one pint of water and a pint of milk. Cook the vegetables thoroughly

in water and mash through a colander. To this water and pulp add a cream sauce made in the proportion of 4 tablespoonsful of flour, 4 tablespoonsful of butter and a pint of milk for vegetables poor in starch or protein. Add 2 tablespoonsful of flour, 2 tablespoonsful of butter and a pint of milk for those rich in protein. Season to taste.

Tomato acid should be counteracted by the addition of one-eighth tablespoonful of soda before the milk is added.

Potato soup may be flavored with onion or celery, or both.

SEMI-SOLID FOODS.

The following lists of foods are given for ready reference.*

Jellies.

(a) Meat Jellies and gelatin; veal, beef, chicken, mutton.

(b) Starch Jellies, flavored with fruit; cornstarch, arrowroot, sago, tapioca.

(c) Fruit jellies and gelatin.

Custards.

(a) Junkets, milk or milk and egg (rennet curdled), flavored with nutmeg, etc.

(b) Egg, milk custard, boiled or baked.

(c) Corn starch, tapioca, boiled custard.

(d) Frozen custard (New York Ice cream.)

Gruels. (Farinaceous)

(a) Milk gruels.

(b) Water gruels.

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* "Nutrition and Diatetics" by Dr. W. S. Hall, D. Appleton & Co., New York.

Toasts.

(a) Cream toast.
(b) Milk toast.
(c) Water toast.

Creams.

(a) Plain.
(b) Whipped.
(c) Ice cream.

Oils.

(a) Plain olive, cotton seed, or nut.
(b) Butter.
(c) Emulsion, as mayonnaise.
(d) Cod liver oil, plain or emulsified.

SOLID FOODS.
(Suitable for Invalids.)

Cereals.

(a) Porridges and mushes—Oatmeal, cornmeal, wheat, rice, etc.
(b) Dry preparations—Shredded wheat biscuit, corn flakes, puffed rice, puffed wheat, triscuit.

Breads.

(a) Plain—White, graham, nutri-meal, whole wheat, brown, rye, etc.
(b) Toasts—Dry, buttered, zweiback.
(c) Crackers—Soda, graham, oatmeal, Boston butter, milk.
(d) Biscuits—Yeast biscuits (24 hours old), baking powder biscuit, beaten biscuit.

Egg Preparations.

(a) Boiled, poached, scrambled, baked.
(b) Omelets.
(c) Souffles of meat and of potatoes.

Meats.

(a) Beef or mutton—Broiled or roasted.
(b) Chicken, turkey or game—Broiled or roasted.
(c) Fish—Broiled, boiled or baked.
(d) Oysters—Canned, stewed, etc.
(e) Clams—Chowder, broiled or baked.

Vegetables.

(a) Potatoes—Baked, boiled, creamed and escalloped.
(b) Sweet potatoes, baked and boiled.
(d) Lima beans, plain and creamed; string beans, plain and creamed; cauliflower, plain and creamed; carrots, parsnips.
(c) Green peas, plain and creamed.
(d) Lima beans, plain and creamed; string beans, plain and creamed cauliflower, plain and creamed; carrots, parsnips.

Fruits.

(a) Fresh—Oranges, grapes, melons, etc. etc.
(b) Stewed apples, plums, apricots, pears, berries, etc.
(c) Baked apples, bananas, pears.
(d) Canned peaches, apricots, plums, pears.
(e) Preserved peaches, plums.

SEMI-SOLID FOODS.

JELLIES. Meat Jellies are made in two ways:

(1) Cook soup meat (containing gristle and bone) slowly for a long time in just enough water to cover. Strain and set the liquid away in a mold to cool and set. If desired, bits of shredded meat may be added to the liquid before molding.

(2) Use meat broth and gelatin in the proportion of one tablespoon gelatin to three quarters of a cup of hot broth. Pour into mold and set on ice.

Starch Jellies.—Starch Jellies are made by cooking in a pint of fruit juice or water until clear, two tablespoons of tapioca, arrowroot, sago, cornstarch, or flour. Sweeten to taste.

If water is used, fresh fruit may be used either in the jelly or in a sauce poured over the jelly.

Fruit Jellies.—These are made:

(1) Of fruit juice and sugar in equal quantities, cooked until it will set when cooled;

(2) Of fruit juice and gelatin in the proportion of one tablespoon of gelatin to three fourths of a cup of fruit juice, or one half box gelatin to one and a half pints of juice. Sugar to taste. Made tea or coffee, or cocoa or lemonade may be used in the same proportion.

CUSTARDS.—These are made with (1) milk, (2) milk and eggs, (3) milk, egg and some farinaceous substances as rice, corn-

starch, tapioca. In the first the coagulum is produced by the addition of rennet, in the other two by the application of heat.

Plain Junket.—Dissolve in a cup of lukewarm milk (never warmer), a tablespoon of sugar or caramel syrup. Add a quarter of a junket tablet, previously dissolved in a tablespoon of cold water. Stir a few times, add vanilla, nuts, or nutmeg if desired. Pour into a cup and set aside to cool and solidify. This may be served plain or with whipped cream, or boiled custard.

Egg-Milk Custard.—When eggs are used for thickening, not less than four eggs should be used to a quart of milk (more eggs make it richer).

Boiled Custard.—One pint of milk, two eggs, half cup of sugar, half saltspoon of salt. Scald the milk, add the salt and sugar, and stir until dissolved. Beat the eggs very thick and smooth. Pour the boiling milk on the eggs slowly, stirring all the time. Pour the mixture into a double boiler, set over the fire and stir for ten minutes. Add flavoring. As soon as a thickening of the mixture is noticed remove from the fire, pour into a dish and set away to cool. This custard makes **cup custard,** the sauce for such puddings as **snow pudding,** and when decorated with spoonfuls of beaten egg-white, makes **floating island.**

Baked Custard.—Proceed as in boiled custard, but instead of pouring into a double boiler pour into a baking dish. Set the dish in a pan of water, place in the oven and bake until the mixture is set in the middle.

Farinaceous Custards.—Make like boiled custard, using one less egg and adding one quarter cup of farina, tapioca, cornstarch, arrowroot, or cooked rice to the hot milk and egg.

Sago should be soaked over night before using.

Tapioca should be soaked one hour before using.

Coffee Custard.—Scald one tablespoon of ground coffee in milk and strain before proceeding as for boiled custard.

Chocolate Custard.—Add one square of grated chocolate to the milk.

Caramel Custard.—Melt the dry sugar until golden brown, add the hot milk, and when dissolved proceed as before. Bake.

GRUELS.—Gruels are a mixture of grain or flour with either milk or water. They require long cooking and may be flavored with sugar, nutmeg, cinnamon, or almond.

Take the meal or flour (oatmeal, two tablespoons, or cornmeal, one tablespoon, or arrowroot, one and a half tablespoons). Sift it slowly into one and a half cups boiling water, simmer for an hour or two. Strain off the liquid; add to it one teaspoon of sugar, season with salt, and add one cup of warm milk.

Water Gruel.—If water gruel is desired, let the last cup of liquid added be water instead of milk.

Cream Gruel.—A cream gruel may be made by using rich cream instead of milk or water.

Barley Gruel.—Barley gruel (usually a water gruel) is prepared as follows: Moisten four tablespoons of barley flour in a little cold water and add it slowly to the boiling water. Stir and boil for twenty minutes.

TOASTS.—Cream Toast.—Toast the bread slowly until brown on both sides. Butter and pour over each slice enough warm cream to moisten (the cream may be thickened slightly and the butter may be omitted.)

Milk Toast.—One tablespoon of cornstarch or flour; one cup of milk, salt to taste, and boil. Butter the toast and pour over it the above white sauce.

Water Toast.—Pour over plain or buttered toast enough boiling water to thoroughly moisten it.

SOUFFLES OF FRUIT, ETC.— The distinguishing feature of a souffle is a pastry or pulpy foundation mixture, and the addition of stiffly beaten egg-white. A souffle may or may not be baked.

Plain Souffle.—Two tablespoons flour; one cup of liquid (water, milk, or fruit juice); three or four eggs; sugar to suit the fruit. If thick fruit pulp is used, omit the thickening. Beat the egg yolks until thick. Add sugar gradually and continue beating. Add the fruit (if lemon juice add some rind also). Fold in the well-beaten whites. Bake in a buttered dish (set in a pan of hot water) for thirty-five or forty minutes in a slow oven.

Fresh Fruit Souffle.—Reduce the fruit to a pulp. Strawberries, peaches, prunes, apples, bananas, etc., may be used. Sweeten the pulp. Beat the egg-white to a stiff froth, add the fruit pulp slowly. Chill and serve with whipped cream or soft custard.

Chocolate Souffle.—Two tablespoons flour; two tablespoons butter; three quarters cup of milk; one third cup of sugar; two tablespoons hot water. Melt the butter, add the flour and stir well. Pour the milk in gradually and cook until well boiled. Add the melted chocolate, to which the sugar and hot water have been added. Beat in the yolks and fold in the whites of the eggs. Bake twenty-five minutes.

Farina Souffle.—Cook the farina (four tablespoons) in a pint of boiling water. Stir this with the egg-yolks, add sugar or salt, and later fold in the egg-whites, flavor, and set away to cool.

The following tables are from "Food and Dietetics," (Norton), published by the American School of Home Economics, Chicago. They are used in a number of schools of Domestic Science and in Dietetic kitchens in hospitals.

These tables are exceptionally valuable in compiling diets in various combinations. One readily determines the number of grams in various servings of different foods. For example—a small serving of beef (round), containing some fat, weighs 36 grams; forty per cent; 14.4 grams, is protein, and sixty per cent, 21.6 grams, is fat, (no carbohydrates). One ordinary thick slice of white, home made bread weighs 38 grams; thirteen per cent, 4.94 grams, is protein, six per cent 2.28 grams is fat and eighty-one per cent, 30.78 grams, is corbohydrate.

One can readily make up the proportions of proteins, carbohydrates and fats required by the average individual suggested on pages 217-218 from various combinations of foods. Each individual may make this study for himself to know whether his system is receiving too much in quantity, or too large a proportion of proteins or of carbohydrates or of fats.

TABLE OF 100 FOOD UNITS

Name of Food	"Portion" Containing 100 Food Units (approx.)	Wt. of 100 Calories		Per cent of		
		Grams	Oz.	Proteid	Fat	Carbo-hydrate
COOKED MEATS						
†Beef, r'nd, boiled (fat)	Small serving	36	1.3	40	60	00
†Beef, r'd, boiled (lean)	Large serving	62	2.2	90	10	00
†Beef, r'd, boiled (med.)	Small serving	44	1.6	60	40	00
†Beef, 5th rib, roasted	Half serving	18.5	.65	12	88	00
†Beef, 5th rib, roasted	Very small s'v'g	25	.88	18	82	00
‡Beef, ribs boiled	Small serving	30	1.1	27	73	00
*Calves foot jelly		112	4.	19	00	81
*Chicken, canned	One thin slice	27	.96	23	77	00
*Lamb chops, boiled, av	One small shop	27	.96	24	76	00
*Lamb, leg, roasted	Ord. serving	50	1.8	40	60	00
†Mutton, leg, boiled	Large serving	34	1.2	35	65	00
†Pork, ham, boiled (fat)	Small serving	20.5	.73	14	86	00
†Pork, ham, boiled	Ord. serving	32.5	1.1	28	72	00
†Pork, ham, r'st'd, (fat)	Small serving	27	.96	19	81	00
†Pork, ham, r'st'd, (lean)	Small serving	34	1.2	33	67	00
*Turkey, as pur., canned	Small serving	28	.99	23	77	00
†Veal, leg, boiled	Large serving	67.5	2.4	73	27	00
VEGETABLES						
*Artichokes, av. canned		430	15	14	0	86
*Asparagus, av. canned		540	19	33	5	62
*Asparagus, av. cooked		206	7.19	18	63	19
*Beans, baked, canned	Small side dish	75	2.66	21	18	61
*Beans, Lima, canned	Large side dish	126	4.44	21	4	75
*Beans, string, cooked	Five servings	480	16.66	15	48	37
*Beets edible portion, cooked	Three servings	245	8.7	2	23	75
*Cabbage, edible portion		310	11	20	8	72
Carrots, cooked	Two servings	164	5.81	10	34	56
*Cauliflower, as purchased		312	11	23	15	62
*Celery, edible portion		540	19	24	5	71
Corn, sweet, cooked	One side dish	99	3.5	13	10	77
*Cucumbers, edible pt		565	20	18	10	72
*Egg plant, edible pt		350	12	17	10	73

Name of Food	"Portion" Containing 100 Food Units (approx.)	Wt. of 100 Calories Grams	Wt. of 100 Calories Oz.	Per cent of Proteid	Per cent of Fat	Per cent of Carbohydrate
VEGETABLES (Continued)						
Lentils, cooked		89	3.15	27	1	72
*Lettuce, edible pt		505	18	25	14	61
*Mushrooms, as purchased		215	7.6	31	8	61
Onions, fresh, edible pt		200	7.1	13	5	82
*Onions, cooked	2 large s'v'gs.	240	8.4	12	40	48
Parsnips, cooked		163	5.84	10	34	56
*Peas, green, canned	Two servings	178	6.3	25	3	72
*Peas, green, cooked	One serving	85	3	23	27	50
Potatoes, baked	One good sized	86	3.05	11	1	88
*Potatoes, boiled	One large sized	102	3.62	11	1	88
*Potatoes, mashed (creamed)	One serving	89	3.14	10	25	65
*Potatoes, chips	One-half s'v'g.	17	.6	4	63	33
*Potatoes, sweet, cooked	Half av. potato	49	1.7	6	9	85
*Pumpkins, edible pt		380	13	15	4	81
Radishes, as purchased		480	17	18	3	79
Rhubarb, edible, pt		430	15	10	27	63
*Spinach, cooked	Two ord. s'v'g.	174	6.1	15	66	19
Squash, edible pt		210	7.4	12	10	78
*Succotash, canned	Ord. serving	100	3.5	15	9	67
*Tomatoes, fresh as purchased	Four av.	430	15	15	16	69
Tomatoes, canned		431	15.2	21	7	72
*Turnips, edible pt	2 large s'v'gs.	246	8.7	13	4	83
Vegetable oysters		273	9.62	10	51	39
FRUITS (DRIED)						
*Apples, as purchased		34	1.2	3	7	90
Apricots, as purchased		35	1.24	7	3	90
*Dates, edible portion	Three large	28	.99	2	7	91
*Dates, as purchased		31	1.1	2	7	91
*Figs, edible portion	One large	31	1.1	5	0	95
*Prunes, edible portion	Three large	32	1.14	3	0	97
*Prunes, as purchased		38	1.35	3	0	97
*Raisins, edible portion		28	1.	3	9	88
*Raisins, as purchased		31	1.1	3	9	88

Name of Food	"Portion" Containing 100 Food Units (approx.)	Wt. of 100 Calories Grams	Wt. of 100 Calories Oz.	Per cent of Proteid	Per cent of Fat	Per cent of Carbohydrate

FRUITS (FRESH OR COOKED)

Name of Food	"Portion" Containing 100 Food Units (approx.)	Grams	Oz.	Proteid	Fat	Carbohydrate
*Apples, as purchased	Two apples	206	7.3	3	7	90
Apples, baked		94	3.3	2	5	93
Apples, sauce	Ord. serving	111	3.9	2	5	93
Apricots, cooked	Large serving	131	4.61	6	0	94
*Bananas, edible pt	One large	100	3.5	5	5	90
*Blackberries		170	5.9	9	16	75
Blueberries		128	4.6	3	8	89
*Blueberries, canned		165	5.8	4	9	87
Cantaloupe	Half or. serv'g	243	8.6	6	0	94
*Cherries, edible portion		124	4.4	5	10	85
*Cranberries, as purchased		210	7.5	3	12	85
*Grapes, as purchased av		136	4.8	5	15	80
Grape fruit		215	7.57	7	4	89
Grape juice	Small glass	120	4.2	0	0	100
Gooseberries		261	9.2	5	0	95
Lemons		215	7.57	9	14	77
*Lemon juice		246	8.77	0	0	100
Nectarines		147	5.18	4	0	96
Olives, ripe	About seven	37	1.31	2	91	7
Oranges, as purchased, av	One very large	270	9.4	6	3	91
*Oranges, juice	Large glass	188	6.62	0	0	100
Peaches, as purchased av	Three ordinary	290	10.	7	2	91
*Peaches, sauce	Ord. serving	136	4.78	4	2	94
Peaches, juice	Ordinary glass	136	4.80	0	0	100
Pears	One large pear	173	5.40	4	7	89
*Pears, sauce		113	3.98	3	4	93
Pineapples, edible p't'n, av		226	8.	4	6	90
*Raspberries, black		146	5.18	10	14	76
Raspberries, red		178	6.29	8	0	92
Strawberries, av	Two servings	260	9.1	10	15	75
*Watermelon, av		760	27.	6	6	88

Name of Food	"Portion" Containing 100 Food Units (approx.)	Wt. of 100 Calories		Per cent of		
		Grams	Oz.	Proteid	Fat	Carbohydrate
DAIRY PRODUCTS						
*Butter	Ordinary pat	12.5	.44	.5	99.5	00
*Buttermilk	1½ glass	275	9.7	34	12	54
*Cheese, Am., pale	1½ cubic in	22	.77	25	73	2
*Cheese, cottage	4 cubic in	89	3.12	76	8	16
*Cheese, full cream	1½ cubic in	23	.82	25	73	2
*Cheese, Neufchatel	1½ cubic in	29.5	1.05	22	76	2
*Cheese, Swiss	1½ cubic in	23	.8	25	74	1
*Cheese, pineapple	1½ cubic in	20	.72	25	73	2
*Cream	¼ ord. glass	49	1.7	5	86	9
Kumyss		188	6.7	21	37	42
*Milk, condensed, sweetened		30	1.06	10	23	67
*Milk, condensed, unsweet'd		59	2.05	24	50	26
*Milk, skimmed	1½ glass	255	9.4	37	7	56
*Milk, whole	Small glass	140	4.9	19	52	29
Milk, human, 2nd week		162	5.7	11	47	42
Milk, human, 3rd month		171	6	7	46	47
*Whey	Two glasses	360	13	15	10	75
CAKES, PASTRY, PUDDINGS AND DESSERTS						
*Cake, chocolate layer	Half ord. sq. pc	28	.98	7	22	71
*Cake, gingerbread	Half ord. sq. pc	27	.96	6	23	71
Cake, sponge	Small piece	25	.89	7	25	68
Custard, caramel		71	2.51	19	10	71
Custard, milk	Ordinary cup	122	4.29	26	56	18
Custard, tapioca	Two-thirds ord	69.5	2.45	9	12	79
*Doughnuts	Half a doughn't	23	.8	6	45	49
*Lady fingers	Two	27	.95	10	12	78
*Macaroons	Four	23	.82	6	33	61
*Pie, apple	One-third piece	38	1.3	5	32	63
*Pie, cream	One-fourth pc	30	1.1	5	32	63
*Pie, custard	One-third piece	55	1.9	9	32	59
*Pie, lemon	One-third piece	38	1.35	6	36	58
*Pie, mince	One-fourth piece	35	1.2	8	38	54
*Pie, squash	One-third piece	55	1.9	10	42	48

Name of Food	"Portion" Containing 100 Food Units (approx.)	Wt. of 100 Calories Grams	Oz.	Per cent of Protied	Fat	Carbo-hydrate
CAKES, PASTRY, PUDDINGS AND DESSERTS (Continued)						
Pudding, apple sago		81	3.02	6	3	91
Pudding, brown betty	Half ord.. s'v'g	56.6	2.	7	12	81
Pudding, cream rice	Very small s'v'g	75	2.65	8	13	79
Pudding, Indian meal	Half ord. ser'g	56.6	2.	12	25	63
Pudding, apple tapioca	Small serving	79	2.8	1	1	98
Tapioca, cooked	Ord. serving	108	3.85	1	1	98
SWEETS AND PICKLES						
*Catsup, tomato, av		170	6.	10	3	87
Candy, plain		26	.9	0	0	100
Candy, chocolate		30	1.1	1	4	95
*Honey	Four teasp'ns	30	1.05	1	0	99
*Marmalade (orange)		28.3	1	.5	2.5	97
*Molasses, cane		35	1.2	.5	0	99.5
*Olives, green edible portion	Five to seven	32	1.1	1	84	15
*Olives, ripe, edible portion	Five to seven	38	1.3	2	91	7
*Pickles, mixed		415	14.6	18	15	67
*Sugar, granulated	Three heaping tsp or 1½ lumps	24	.86	0	0	100
*Sugar, maple	Four teaspoons	29	1.03	0	0	100
*Syrup, maple	Four teaspoons	35	1.2	0	0	100
NUTS, EDIBLE PORTION						
*Almonds, av	Eight to 15	15	.53	13	77	10
*Beechnuts		14.8	.52	13	79	8
*Brazil nuts	Three ord. size	14	.49	10	86	4
*Butternuts		14	.50	16	82	2
*Cocoanuts		16	.57	4	77	19
*Chestnuts, fresh, av		40	1.4	10	20	70
* Filberts, av	Ten nuts	14	.48	9	84	7
*Hickory nuts		13	.47	9	85	6

Name of Food	"Portion" Containing 100 Food Units (approx.)	Wt. of 100 Calories		Per cent of		
		Grams	Oz.	Proteid	Fat	Carbo-hydrate

NUTS, EDIBLE PORTION (Continued)

*Peanuts, av.	Thirteen double	18	.62	20	63	17
*Pecans, polished	About eight	13	.46	6	87	7
*Pine nuts, (pignolias)	About eighty	16	.56	22	74	4
*Walnuts, California	About six	14	.48	10	83	7

CEREALS

*Bread, brown, average	Ord. thick slice	43	1.5	9	7	84
*Bread, corn (johnnycake) av.	Small square	38	1.3	12	16	72
*Bread, white, home made	Ord. thick slice	38	1.3	13	6	81
*Cookies, sugar	Two	24	.83	7	22	71
Corn flakes, toasted	Ord. cer. dish f'l	27	.97	11	1	88
*Corn meal, granular, av.	2½ level tbsp	27	.96	10	5	85
Corn meal, unbolted, av.	Three tbsp	26	.92	9	11	80
* Crackers, graham	Two crackers	23	.82	9.5	20.5	70
*Crackers, oatmeal	Two crackers	23	.81	11	24	65
*Crackers, soda	3½ "Uneedas"	24	.83	9.4	20	70.6
*Hominy, cooked	Large serving	120	4.2	11	2	87
*Macaroni, av.		27	.96	15	2	83
Macaroni, cooked	Ord. serving	110	3.85	14	15	71
*Oatmeal, boiled	1½ serving	159	5.6	18	7	75
*Popcorn		24	.86	11	11	78
*Rice, uncooked		28	.98	9	1	90
*Rice, boiled	Ord. cereal dish	87	3.1	10	1	89
*Rice, flakes	Ord. cereal dish	27	.94	8	1	91
*Rolls, Vienna, av.	One large roll	35	1.2	12	7	81
*Shredded wheat	One biscuit	27	.94	13	4.5	82.5
*Spaghetti, average		28	.97	12	1	87
*Wafers, vanilla	Four	24	.84	8	13	71
Wheat, flour, e't'e w'h't, av.	Four tbsp	27	.96	15	5	80
*Wheat, flour, graham, av.	4½ tbsp	27	.96	15	5	80
*Wheat, flour, patent, family and straight grade spring wheat, av.	Four tbsp	27	.97	12	3	85
*Zwiebach	Size of thick slice of bread	23	.81	9	21	70

Name of Food	"Portion" Containing 100 Food Units (approx.)	Wt. of 100 Calories		Per cent of		
		Grams	Oz.	Proteid	Fat	Carbo-hydrate
	MISCELLANEOUS					
*Eggs, hen's boiled	One large egg	59	2.1	32	68	00
*Eggs, hen's whites	Of six eggs	181	6.4	100	0	00
*Eggs, hen's yolks	Two yolks	27	.94	17	83	00
*Omelet		94	3.3	34	60	6
*Soup, beef, av		380	13.	69	14	17
*Soup, bean, av	Very large plate	150	5.4	20	20	60
*Soup, cream of celery	Two plates	180	6.3	16	47	37
*Consomme		830	29.	85	00	15
*Clam chowder	Two plates	230	8.25	17	18	65
*Chocolate, bitter	Half-a-square	16	.56	8	72	20
*Cocoa		20	.69	17	53	30
Ice cream (Phila)	Half serving	45	1.6	5	57	38
Ice cream (New York)	Half serving	48	1.7	7	47	46

*Chemical Composition of American Food Materials. Atwater and Bryant, U. S. Department of Agricultural Bull. No. 28.
†Experiments on Losses in Cooking Meats. (1900-03), Grindley, U. S. Department of Agricultural Bull. No. 141.
‡Laboratory number of specimen, as per Experiments on Losses in Cooking Meat.

Tables Showing Average Height, Weight, Skin Surface and Food Units Required Daily With Very Light Exercise

BOYS

Age	Height in Inches	Weight in Pounds	Surface in Square Feet	Calories or Food Units
5	41.57	41.09	7.9	816.2
6	43.75	45.17	8.3	855.9
7	45.74	49.07	8.8	912.4
8	47.76	53.92	9.4	981.1
9	49.69	59.23	9.9	1,043.7
10	51.58	65.30	10.5	1,117.5
11	53.33	70.18	11.0	1,178.2
12	55.11	76.92	11.6	1,254.8
13	57.21	84.85	12.4	1,352.6
14	59.88	94.91	13.4	1,471.3

GIRLS

Age	Height in Inches	Weight in Pounds	Surface in Square Feet	Calories or Food Units
5	41.29	39.66	7.7	784.5
6	43.35	43.28	8.1	831.9
7	45.52	47.46	8.5	881.7
8	47.58	52.04	9.2	957.1
9	49.37	57.07	9.7	1,018.5
10	51.34	62.35	10.2	1,081.0
11	53.42	68.84	10.7	1,148.5
12	55.88	78.31	11.8	1,276.8

MEN

Height in In.	Weight in Pounds	Surface in Square Ft.	Calories or Food Units Proteids	Fats	Carbohydrates	Total
61	131	15.92	197	591	1,182	1,970
62	133	16.06	200	600	1,200	2,000
63	136	16.27	204	612	1,224	2,040
64	140	16.55	210	630	1,260	2,100
65	143	16.76	215	645	1,290	2,150
66	147	17.06	221	663	1,326	2,210
67	152	17.40	228	684	1,368	2,280
68	157	17.76	236	708	1,416	2,360
69	162	18.12	243	729	1,458	2,430
70	167	18.48	251	753	1,506	2,510
71	173	18.91	260	780	1,560	2,600
72	179	19.34	269	807	1,614	2,690
73	185	19.89	278	834	1,668	2,780
74	192	20.33	288	864	1,728	2,880
75	200	20.88	300	900	1,800	3,000

WOMEN

Height in In.	Weight in Pounds	Surface in Square Ft.	Calories or Food Units Proteids	Fats	Carbohydrates	Total
59	119	14.82	179	537	1,074	1,790
60	122	15.03	183	549	1,098	1,830
61	124	15.29	186	558	1,116	1,860
62	127	15.50	191	573	1,146	1,910
63	131	15.92	197	591	1,182	1,970
64	134	16.13	201	603	1,206	2,010
65	139	16.48	209	627	1,254	2,090
66	143	16.76	215	645	1,290	2,150
67	147	17.06	221	663	1,326	2,210
68	151	17.34	227	681	1,362	2,270
69	155	17.64	232	696	1,392	2,320
70	159	17.92	239	717	1,434	2,390

NOTE—With active exercise an increase of about 20 per cent total food units may be needed.

DIETARY CALCULATION WITH FOOD VALUES IN CALORIES PER OUNCE

Breakfast	Proteids	Fats	Carbo-hydrates	Total
Gluten Gruel 5 oz.	23.5	1.0	30.0	
Soft-Boiled Egg	26.3	41.9		
Malt Honey 1 oz.			86.2	
Creamed Potatoes 5 oz.	15.0	40.0	104.0	
Zwiebach 2 oz.	22.8	52.8	171.6	
Pecans ¾ oz.	8.4	141.0	13.4	
Apple 5 oz.	2.5	6.5	83.0	
	98.5	283.2	488.2	869.9

DIETARY CALCULATION WITH FOOD SERVED IN 100 CALORIES PORTIONS

Dinner	Portions in serving	Proteins	Fats	Carbo-hydrates	Total
French Soup	½	10	20	20	
Nut Sauce	1	29	55	16	
Macaroni, Egg	1	15	59	26	
Baked Potato	2	22	2	176	
Cream Gravy	½	5	33	12	
Biscuit	1½	20	2	128	
Butter	1	1	99		
Honey	2			200	
Celery	¼	4		21	
Apple Juice	½			50	
	10¼	106	270	649	1,025

Hourly Outgo in Heat and Energy from the Human Body as Determined in the Respiration Calorimeter by the U. S. Dept. of Agriculture

Average (154 lbs)	Calories
Man at rest (asleep)	65
Sitting up (awake)	100
Light exercise	170
Moderate exercise	190
Severe exercise	450
Very severe exercise	600

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Foods

Nutrition and Digestion

Susanna Cocroft